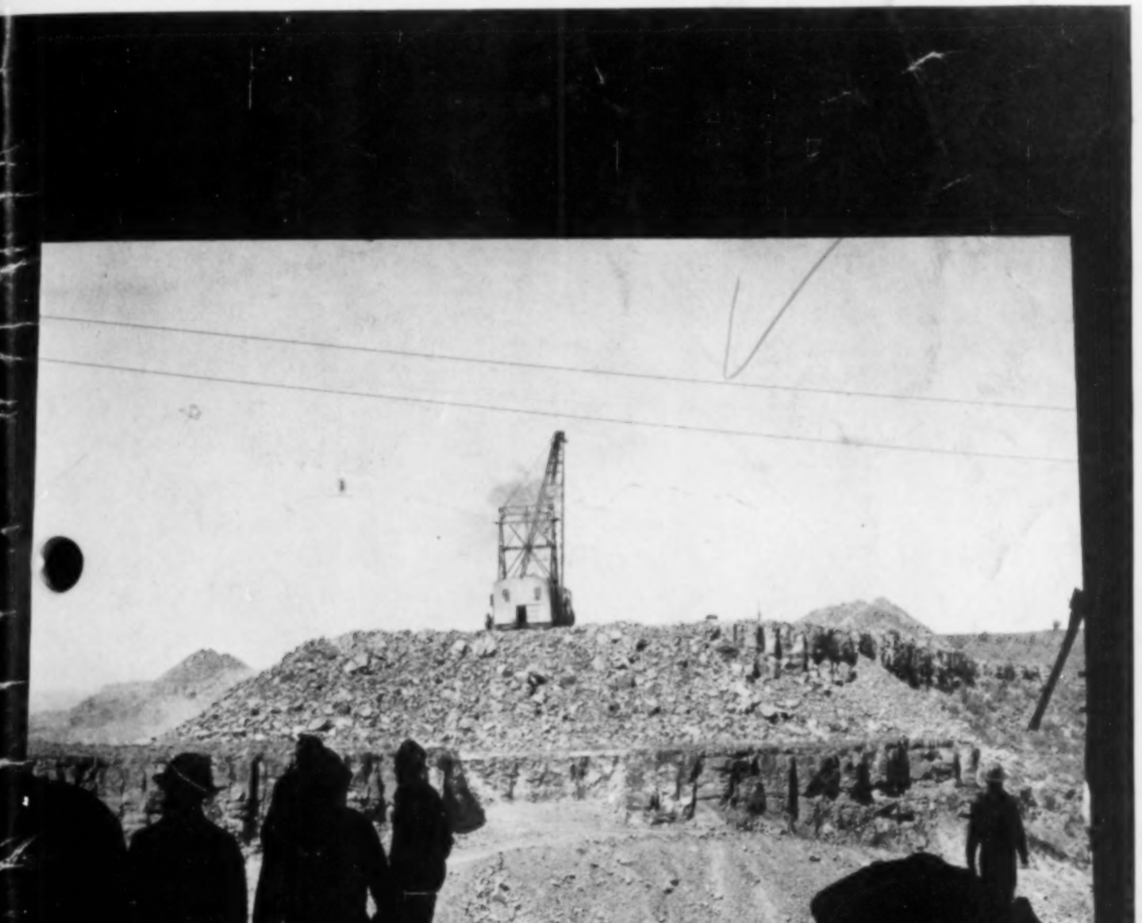
# Compressed Air Magazine

JULY 1947



FRAMED VIEW OF
RECORD DRAGLINE

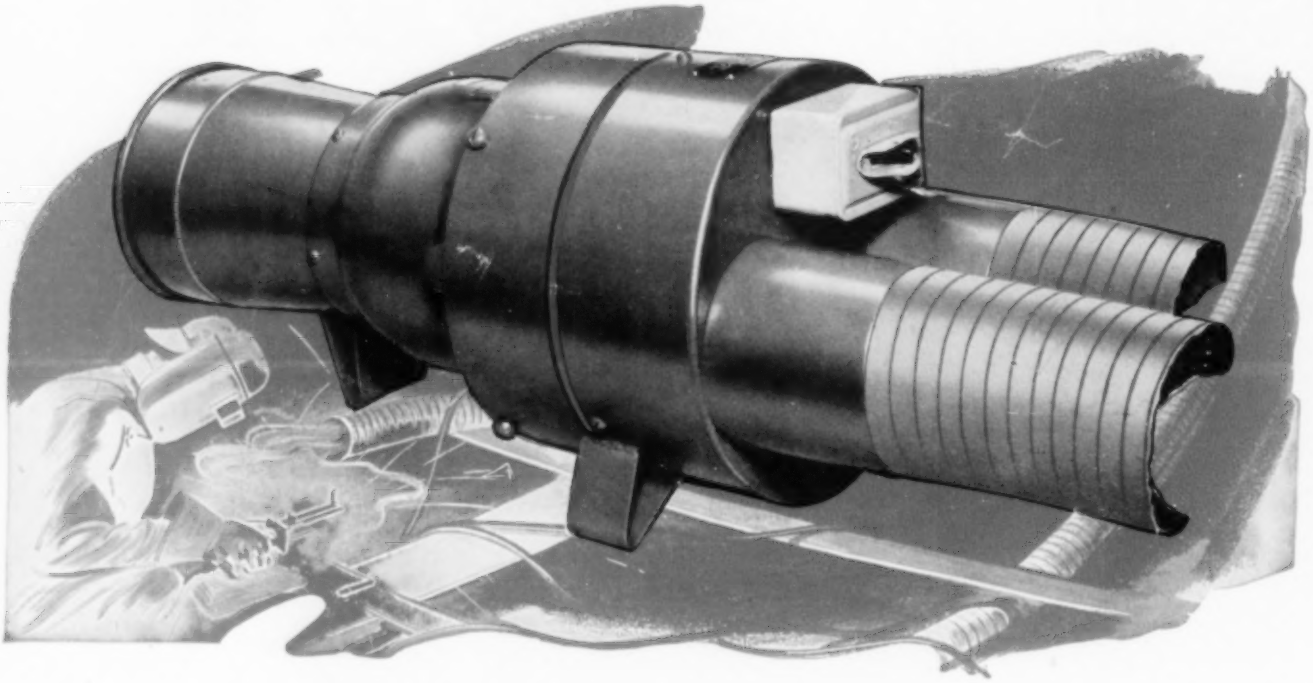
Locking out of intake end of Bacon Tunnel, Columbia River Project, Washington

BUREAU OF RECLAMATION PHOTO

VOLUME 52 • NUMBER 7

NEW YORK • LONDON

# An Extra Lung for A Man
## HAVING TROUBLE BREATHING



The amount of work a man can do goes *down* when foul air comes *in* or the heat goes *up*. Are you giving your workers the equipment that will keep them efficient even when working in hot or noxious fumes?

Many concerns regard Coppus Blowers as "production tools" as well as "safety equipment". They help men to do more work and better work.

You can find in the Coppus line the right blower or exhauster for each "bad spot"—or perhaps one type will handle a variety of jobs. In addition to man-cooling and removing fumes from confined places, Coppus Blowers are used for cooling and drying materials and equipment. They are portable . . . efficient . . . built to Coppus "Blue Ribbon" standards of construction and workmanship in order to withstand severe usage.

Check and mail the coupon for specific information. Address Coppus Engineering Corp., 207 Park Ave., Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in SWEET'S CATALOG, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

ANOTHER
**COPPUS**
"BLUE RIBBON" PRODUCT

**COPPUS ENGINEERING CORP., 207 PARK AVENUE, WORCESTER 2, MASS.**
**Please send me information on the Blowers that clear the air for action.**

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausters, welding fumes
- ☐ stirring up stagnant air wherever men are working or material is drying.

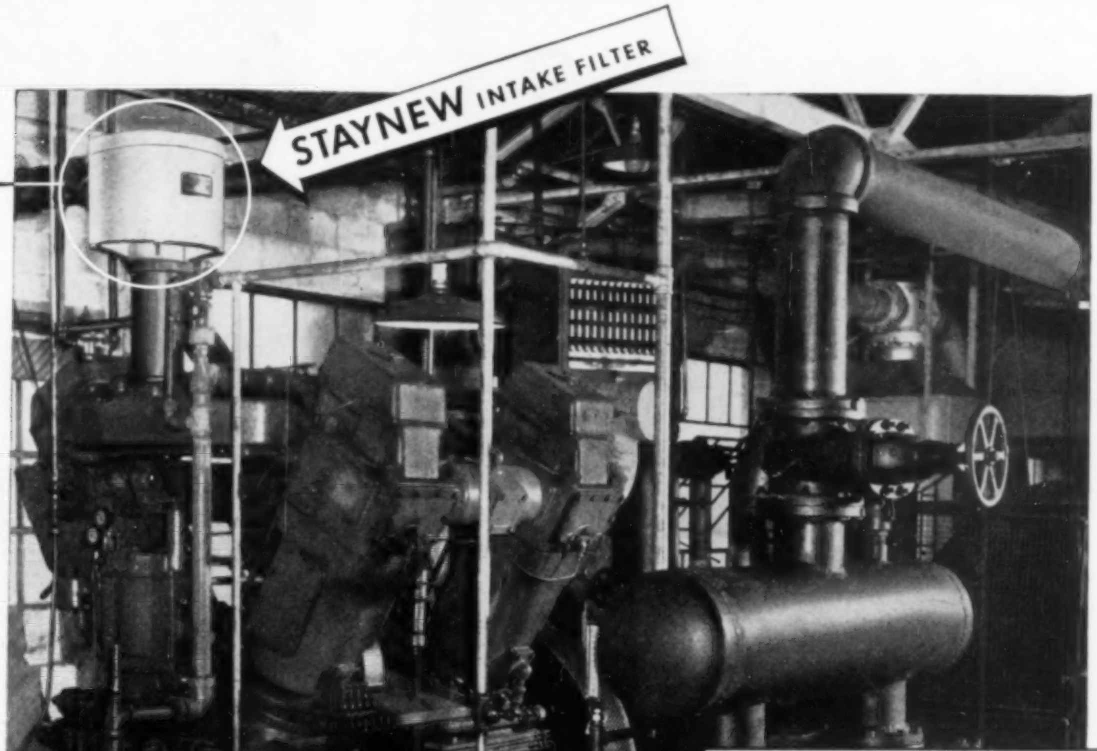
NAME ..................................................

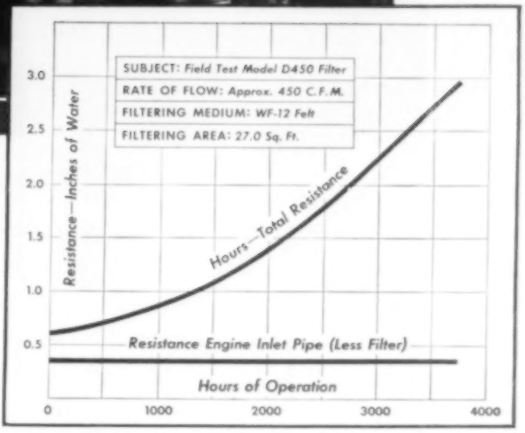
COMPANY ..................................................

ADDRESS ..................................................

CITY ..................................................

(Write here any special ventilating problem you may have).





# 3761 HOURS CONTINUOUS OPERATION WITHOUT ATTENTION

## Yet Filter Resistance Is Only 2.73 Inches of Water

This filter, installed on a Diesel-powered compressor, operates under unusually severe conditions. Intake air is heavily loaded with dust and oil; the dust due to the close proximity of a railroad siding where bulk lime, sand, and coal are handled—the oil to two additional Diesel-powered compressors operating in the same room.

Such a case history is not unusual. Reports are frequently received of Staynew Filters operating under less severe conditions for two or more years without attention—with the initially high efficiency rising as dust load increases.

*Ease of cleaning* as well as infrequency of cleaning is also an important feature, requiring only a few minutes with the specially designed Staynew Cleaning Nozzle.

More and more experienced operators of compressor and engine equipment specify Staynew Intake Filters—not only because of the minimum attention required, but also because these filters:

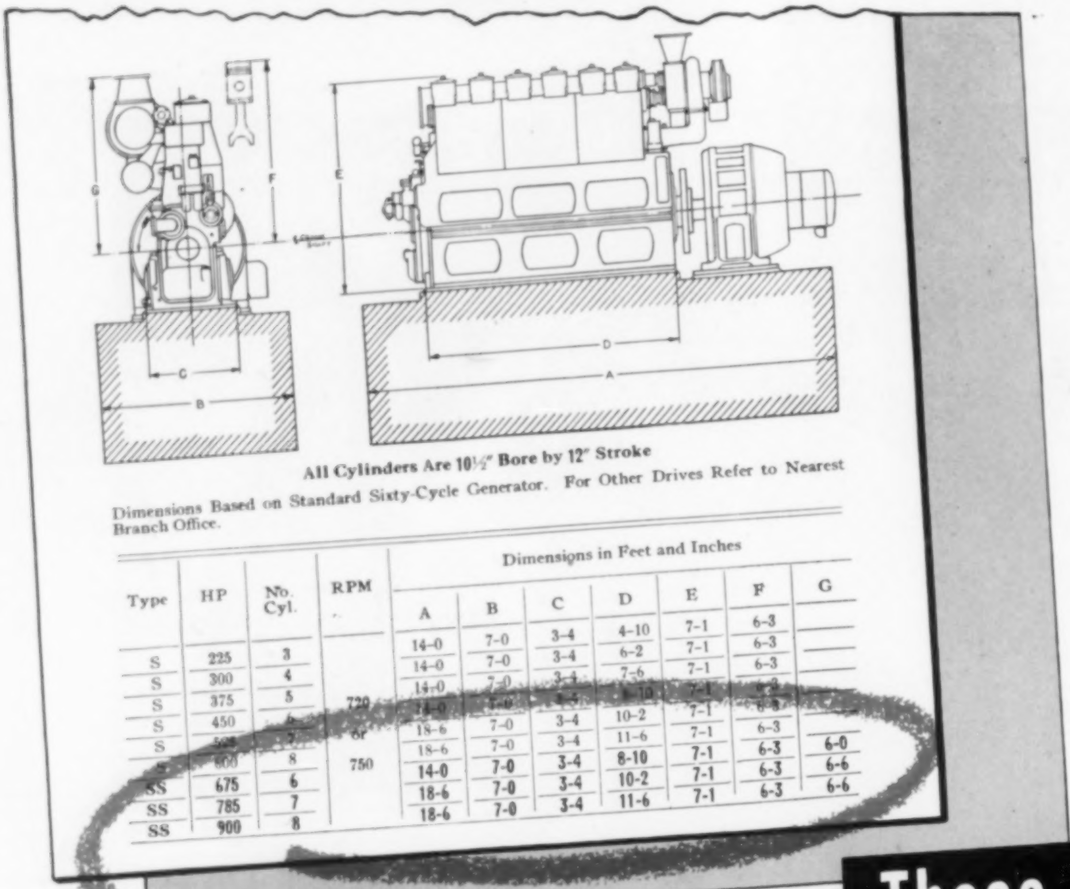
- ★ **Provide positive protection**
- ★ **Require no pre-coat or filter aid**
- ★ **Are unaffected by extremes of temperature**
- ★ **Permit use of oversize filters (air velocity not critical)**
- ★ **Are ideal for use with carbon ring compressors**

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

# DOLLINGER CORPORATION

**7 CENTRE PK., ROCHESTER 3, N. Y.**

IN CANADA: McCARTHY AND ROBINSON ★ ENGINEERING EQUIPMENT CO.
TORONTO, ONT. MONTREAL, QUE.



All Cylinders Are 10½" Bore by 12" Stroke

Dimensions Based on Standard Sixty-Cycle Generator. For Other Drives Refer to Nearest Branch Office.

| Type | HP | No. Cyl. | RPM | Dimensions in Feet and Inches | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | A | B | C | D | E | F | G |
| S | 225 | 3 | 720 or 750 | 14-0 | 7-0 | 3-4 | 4-10 | 7-1 | 6-3 | |
| S | 300 | 4 | | 14-0 | 7-0 | 3-4 | 6-2 | 7-1 | 6-3 | |
| S | 375 | 5 | | 14-0 | 7-0 | 3-4 | 7-6 | 7-1 | 6-3 | |
| S | 450 | 6 | | 14-0 | 7-0 | 3-4 | 8-10 | 7-1 | 6-3 | |
| S | 525 | 7 | | 18-6 | 7-0 | 3-4 | 10-2 | 7-1 | 6-3 | |
| S | 600 | 8 | | 18-6 | 7-0 | 3-4 | 11-6 | 7-1 | 6-3 | |
| SS | 675 | 6 | | 14-0 | 7-0 | 3-4 | 8-10 | 7-1 | 6-3 | 6-0 |
| SS | 785 | 7 | | 18-6 | 7-0 | 3-4 | 10-2 | 7-1 | 6-3 | 6-6 |
| SS | 900 | 8 | | 18-6 | 7-0 | 3-4 | 11-6 | 7-1 | 6-3 | 6-6 |

# These..

# are the TYPE "SS" SUPERCHARGED I-R DIESELS

They are built in three sizes . . . 6 cylinder for 675 hp—7 cylinder for 785 hp—8 cylinder for 900 hp. They develop 50% more power than unsupercharged Type "S" engines having the same number of cylinders and yet retain all the proven advantages of the Type "S" . . . reliability, economy, accessability, low maintenance.

There are other advantages too.

Low fuel consumption (.38 lb per bhp-hour at three-quarter and full load, .40 at half load.)

Less derating at altitudes than in an unsupercharged engine.

Low lubricating oil consumption because increase in power is not obtained by adding cylinders, bearings or similar parts.

Operation of the turbocharger is entirely automatic.

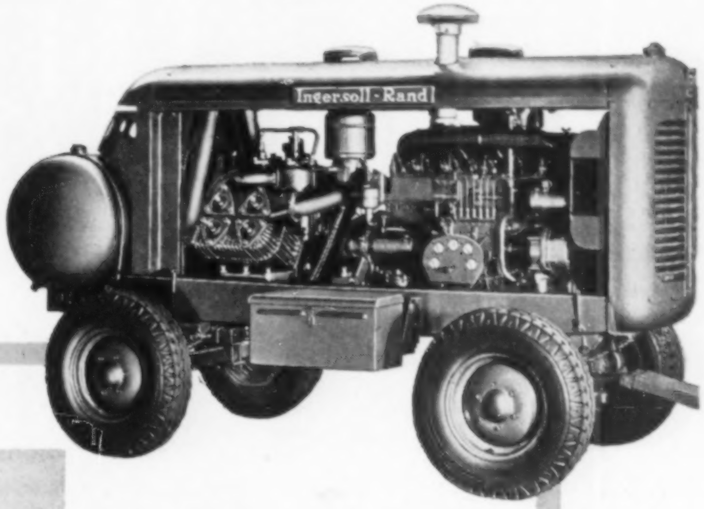
Less Space. An 8 cylinder "Super S" engine requires only 2/3 the floor space and weighs only 66% as much as an unsupercharged engine of equal horsepower.

If you're thinking of a Diesel installation, get in touch with an Ingersoll-Rand Branch Office. Talk it over with our engineers and see just what these turbocharged Diesels will save you.

**COMPRESSORS • AIR TOOLS**
**ROCK DRILLS • TURBO BLOWERS**
**CONDENSERS • CENTRIFUGAL PUMPS**
**OIL & GAS ENGINES**

**Ingersoll-Rand**
11 BROADWAY, NEW YORK 4, N. Y. 9-7

# KEEP VALVES CLEAN...



# GET MORE AIR

**PROTECT YOUR DRILLS.** Effective lubrication does it! Texaco Rock Drill Lubricants (E.P.) prevent rust in service and in storage, resist washout, protect all moving parts against wear even in the heaviest service. They conform to lubrication specifications of leading rock drill manufacturers.

*What's the best way to keep compressor valves clean?*

Effective lubrication—Texaco Alcaid, Algol or Ursa Oil.

*Why those particular oils?*

Because *Texaco Alcaid, Algol* and *Ursa Oils* are especially refined to free them of impurities that form hard carbon deposits. Any slight amount of carbon that may form in use is soft and fluffy—won't impede valve action.

*That all?*

No. These oils keep rings free, too—and ports and air lines clear. Your compressors run more efficiently, give full air pressure at your drills. Thus you have less maintenance expense—fewer repairs and overhauls.

*All right, which of the three do I use—Alcaid, Algol or Ursa Oil?*

They're all in the same series, developed for effective compressor lubrication. Use the one recommended by Texaco Lubrication Engineering Service for your particular operating conditions.

*Where can I get Texaco service and products?*

Just call the nearest of the more than 2500 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

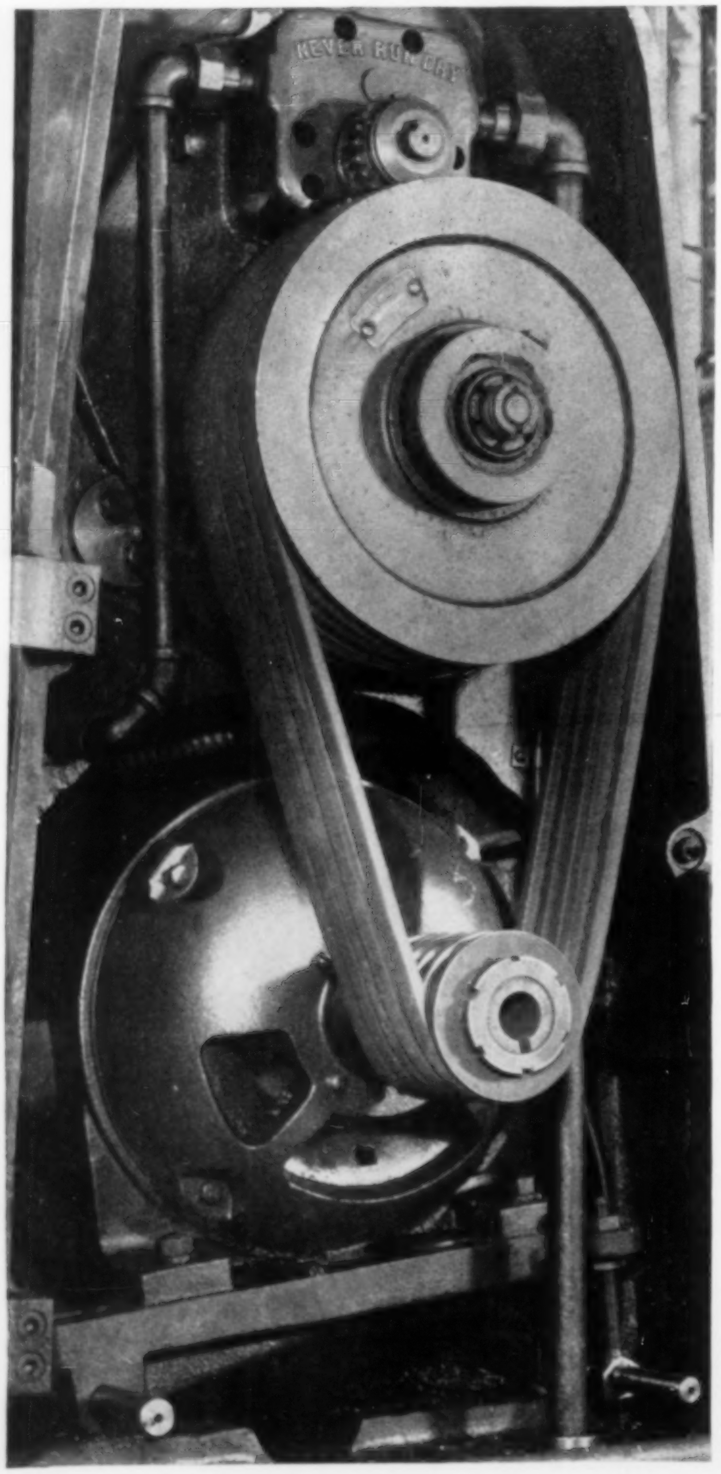
TEXACO REG. T. M.

**TEXACO Lubricants and Fuels**

**FOR ALL CONTRACTORS' EQUIPMENT**

Tune in... TEXACO STAR THEATRE presents the NEW TONY MARTIN SHOW every Sunday night. See newspaper for time and station.

# 5 BILLION·



## FIVE YEARS IN "SOLITARY"!

Many machine tools in the Bell Aircraft plant at Buffalo have pioneer Tri-Clad motors tucked away inside. The result is a sleek exterior for the machine and valuable floor space saved. During the war, when time was short and uninterrupted production was of utmost importance, these motors gave dependable service, demanding only a minimum of lubrication and inspection.

The Tri-Clad motor you see here driving a milling machine has not been removed for five years. Operating in confined quarters, where the volume of cooling air was limited (and laden with oil), it has done its job faithfully, despite the strain of a 3-shift, 7-day work schedule. Thanks to the extra protection built into this and the more than 200 other Tri-Clad motors in the Bell plant, they give every sign of staying on the job indefinitely.

## *NOW*— MOTOR TOUGHNESS AT ITS PEAK

Newest addition to the Tri-Clad motor family is the Tri-Clad totally enclosed, fan-cooled motor. It is designed for use in adverse atmospheres — in iron dust, out-of-doors, in hazardous areas, and chemical atmospheres. Available in both standard and explosion-proof types, this motor gives you these important construction features:

- A cast-iron, double-wall frame which completely encloses and protects the windings and punchings.
- A nonshrinking compound around motor leads which protects motor interior from dust and moisture.
- A rotating labyrinth seal which further protects the motor interior from damage by foreign matter.

# MOTOR HOURS

# PROVE YOU CAN'T BEAT

# TRI-CLAD

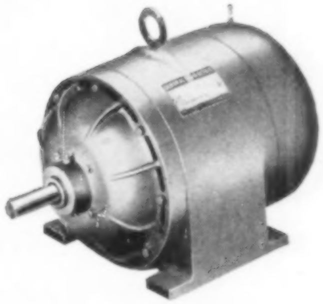
# EXTRA PROTECTION

Since 1941, nearly a million Tri-Clad motors have been purchased by American industry.

Figured conservatively, they have delivered more than 5 billion hours of service — most of this service under war-time conditions when maintenance was infrequent and overloads were the rule.

This Tri-Clad motor record for continuous service under adverse conditions is the best proof we can give you that these motors have *even better protection* than we promised.

Remember, the Tri-Clad motor family now includes dripproof, totally enclosed, vertical, gear, and capacitor-motors. All of these types, we believe, offer you a combination of performance characteristics, horsepower-per-frame-size, and protective features that no other line of general-purpose motors can match. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



### *EXTRA PROTECTION . . .* AGAINST PHYSICAL DAMAGE!

Rigid cast-iron frame and end shields protect vital motor parts from external abuse and also prevent resonance. Because they're not at the mercy of a coat of paint, they strongly resist chemical attack and dampness. Cast iron also gives you tight, *metal-to-metal* fits between end shields and frame.

### *EXTRA PROTECTION . . .* AGAINST ELECTRICAL BREAKDOWN!

Motor windings of Formex* wire, together with improved insulating materials, reduce the chances of electrical failure. Heat is dissipated quickly — motor stays young for years and years!

### *EXTRA PROTECTION . . .* AGAINST OPERATING WEAR AND TEAR!

Bearing design affords longer life, greater capacity, improved lubrication features. Bearing seals retain lubricant, keep out dirt. One-piece, cast-aluminum rotor is practically indestructible.

**Trade-mark reg. U. S. Pat. Off.*

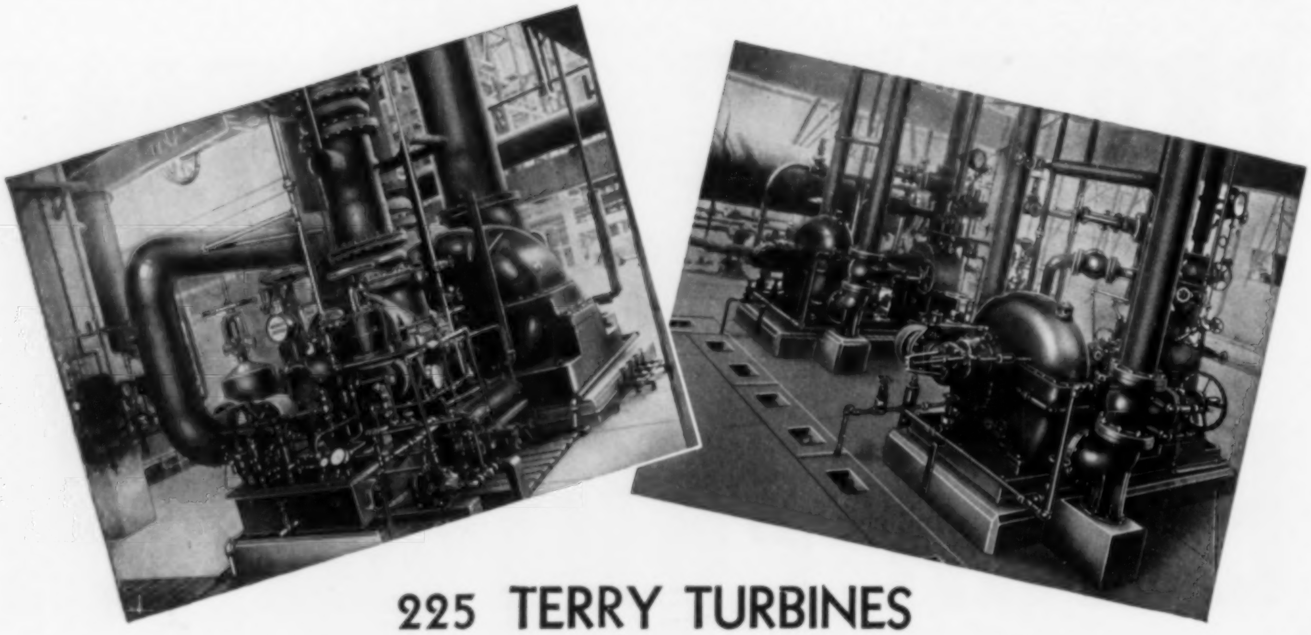
**GENERAL ELECTRIC**

750—286

**TRI-CLAD**
REG US PAT OFF
**MOTORS**

- OPEN (DRIPPROOF)
- TOTALLY ENCLOSED
- EXPLOSION-PROOF

# *The* TERRY TURBINE



## 225 TERRY TURBINES
SERVE THE CITIES SERVICE REFINING CORP.
AT LAKE CHARLES, LA.

These 225 Specially Designed Terry Turbines are used to drive pumps and compressors at the Cities Service Tutwiler Refinery.

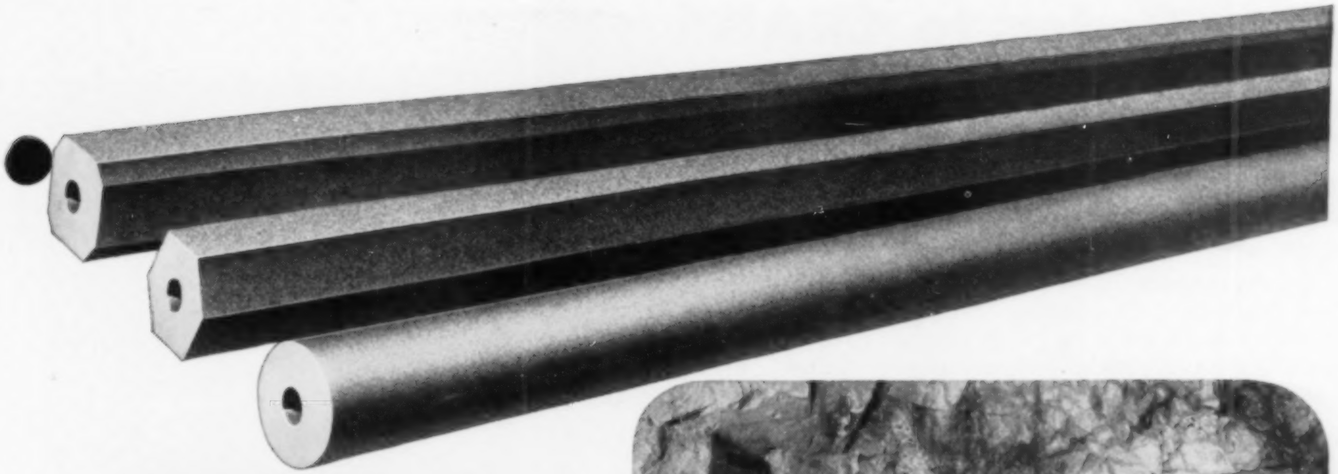
Typical Units are shown above. At the left is an 1800 H. P. condensing multi-staged Turbine direct connected to a blower. At the right are two 175 H. P. Terry solid wheel turbines driving pumps.

The same engineering talent and manufacturing facilities that produced these turbines are available to assist you in obtaining efficient power generation.

Any of our District Representatives will be pleased to give you full information on a turbine drive to meet your requirements. No obligation. May we send you descriptive bulletins?

T-1166

**THE TERRY STEAM TURBINE COMPANY**
**TERRY SQUARE, HARTFORD, CONN.**



# STEEL
## VERSUS
# HARD ROCK

Drilling hard ore-bearing rock calls for drill steel with a pedigree . . . tough, fatigue-resisting steel with inbred quality that will stand up and slug blows, shift after shift.

Bethlehem Hollow is just such a steel, for its inherent quality is born in the fiery melting furnace and developed through the careful handling of the steps in its production.

It's the kind of steel the drill runners like, for it won't let them down. And it's a favorite with blacksmiths because it forges readily to close dimensions and is easy to heat-treat for the ideal hardness.

Whether used for forged-on bits or detachables, there's no better steel for hard-rock drilling. Next time, ask for Bethlehem Hollow.

Bethlehem Steel Company, Bethlehem, Pa.

*On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation*

You're turning out nice shanks, Bill.
Shucks, it's no trouble when I've got BETHLEHEM HOLLOW.

BETHLEHEM STEEL

**BETHLEHEM HOLLOW DRILL STEEL**

# One Order to CRANE covers all the Piping Materials

**ONE**
**SOURCE OF SUPPLY**
**RESPONSIBILITY**
**STANDARD OF QUALITY**

. . . And that goes whether you're installing a boiler or a compressor, a process piping system or a washdown water line. You can get everything from Crane.

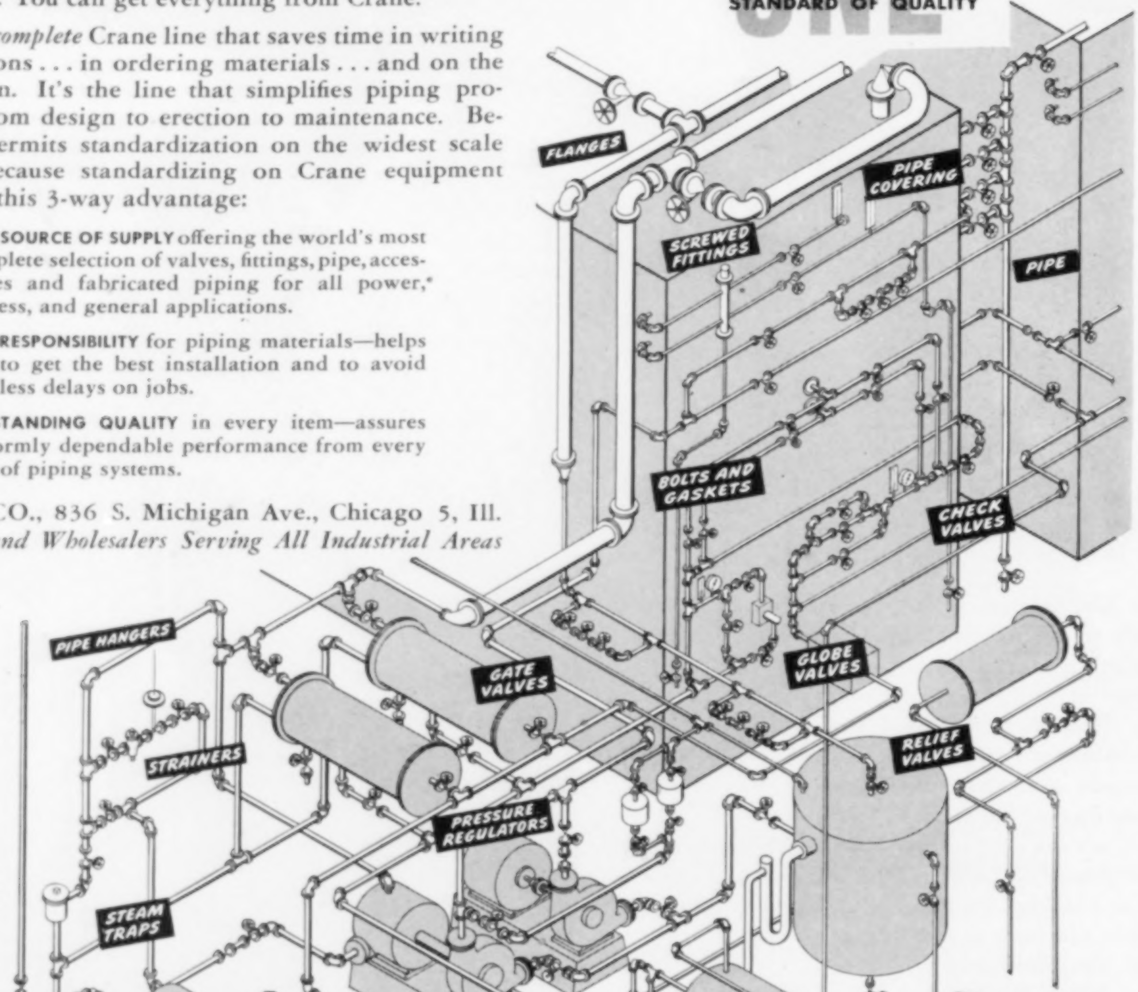
It's the *complete* Crane line that saves time in writing specifications . . . in ordering materials . . . and on the installation. It's the line that simplifies piping procedures from design to erection to maintenance. Because it permits standardization on the widest scale . . . and because standardizing on Crane equipment gives you this 3-way advantage:

**ONE SOURCE OF SUPPLY** offering the world's most complete selection of valves, fittings, pipe, accessories and fabricated piping for all power, process, and general applications.

**ONE RESPONSIBILITY** for piping materials—helps you to get the best installation and to avoid needless delays on jobs.

**OUTSTANDING QUALITY** in every item—assures uniformly dependable performance from every part of piping systems.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
*Branches and Wholesalers Serving All Industrial Areas*


FLANGES
PIPE COVERING
SCREWED FITTINGS
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CHECK VALVES
PIPE HANGERS
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RELIEF VALVES
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STEAM TRAPS
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*Fuel, water and condensate piping to oil-burning boilers.*

CRANE
250 S
500 WOG

(Right) **FOR SATURATED STEAM** *working pressures up to 250 pounds, Crane recommends No. 7E Ferrosteel Wedge Gate Valves. Made of high grade iron 35% stronger than usual cast iron. Ideal for tough services not severe enough to need steel valves. In nonrising stem and OS&Y patterns; flanged or screwed ends. Sizes from 2 in. See Crane Catalog, pps. 110-111.*

***EVERYTHING FROM . . .***

**VALVES • FITTINGS**
**PIPE • PLUMBING**
**AND HEATING**

# CRANE

***FOR EVERY PIPING SYSTEM***

## This MANHATTAN Belt . . . gave 22 years continuous service

**. . . traveled 1,448,864 miles**

The 18-inch, 5-ply Manhattan Transmission Belt pictured here was held in storage over 4 years, followed by *22 years* of actual service. It operated a line shaft in the machine shop of the Huntington and Broad Top Mountain Railroad and Coal Company. This drive is nearly vertical which means that a higher than normal belt tension had to be maintained to prevent slip.

We quote directly from a letter from Mr. F. E. Steele, Superintendent:

> "It is my personal opinion that this is a remarkable service for a belt of this type when we take into consideration the fact that drive pulley was 14 inches in diameter. This within itself would throw considerable strain on a belt of this width and weight, also with a speed of approximately 2,383 feet per minute. During this period of operation we had no trouble whatsoever and at all times the belt worked very satisfactorily."

A lacer accident finally ended its career.

> "Should this accident not have happened, the belt would still be in service and doing a good job."

This is one of many case histories to which Manhattan can point for proof of Workmanship and Quality Materials . . . reasons why Manhattan has long been famous for its belts. Whatever the job, there's a Manhattan Belt that will lower *your* costs, too.

### A SINGLE SOURCE for a COMPLETE BELTING LINE

*Manhattan offers a range of four driving tension surfaces on rubber transmission belts. Also Endless Cord, Non-Spark, Oil-Proof and Acid-Proof constructions. Belts can be factory-made endless or field vulcanized by the Condor-Weld method. All Manhattan endless belts have the patented Extensible-Tip outer-ply splice which prolongs belt life considerably. Literature on request.*

RAYBESTOS R M MANHATTAN

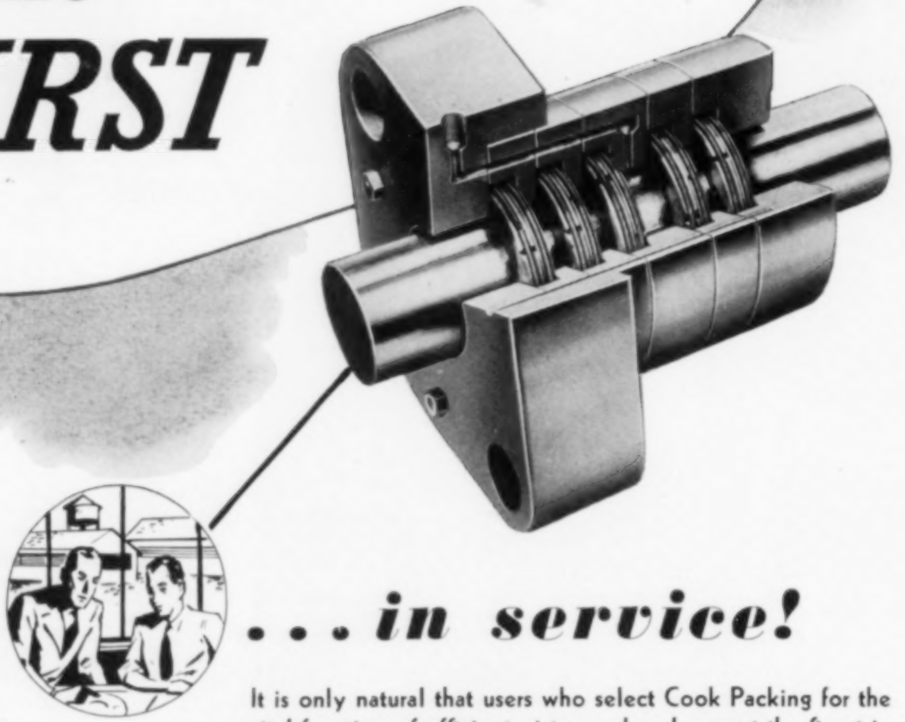
# RAYBESTOS-MANHATTAN INC.

*Keep Ahead with Manhattan*

**MANHATTAN RUBBER DIVISION** **PASSAIC, NEW JERSEY**

BETTER PACKING FOR MORE EFFICIENT RESULTS—THROUGH METALLURGY

# COOK METALLIC PACKINGS are *FIRST*



## . . . *in service!*

It is only natural that users who select Cook Packing for the vital function of efficient piston rod seal expect the finest in engineering service.

Years ago, recognizing that no precision manufactured article, however superior in design and construction, can be any better than the engineering service provided for it, Cook established a realistic service organization.

The result today is a corps of engineers thoroughly trained and experienced both in packing engineering and in all the related phases of engine and compressor operation. In this way, Cook is able to offer to operating engineers maximum assistance in keeping their compressor packings operating at top efficiency.

In these times when good service is so very important and generally so difficult to get—remember Cook service is unequalled in efficiency and dependability.

Sealing Pressures

Since 1888

**C. LEE COOK MANUFACTURING CO.**
INCORPORATED
LOUISVILLE, KY.

BALTIMORE • BOSTON • CHICAGO • CLEVELAND • HOUSTON • LOS ANGELES • MOBILE • NEW ORLEANS • NEW YORK • SAN FRANCISCO • TULSA

J-10
UTILITY
JACKHAMER
INGERSOLL-RAND

FOR THE FIRST TIME!

A UTILITY Jackhamer

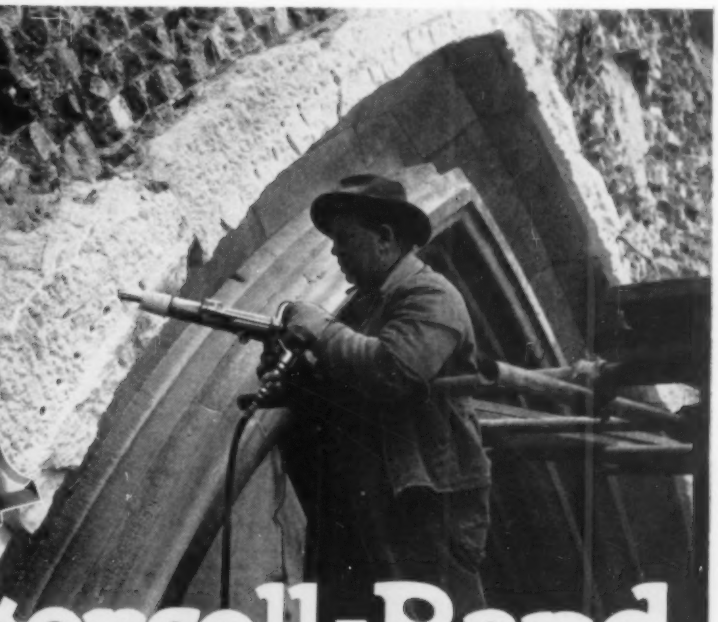
*Having* **UTILITY WEIGHT**
**REAL DRILLING POWER**
**AUTOMATIC ROTATION**
*Air Operated*

This amazingly *powerful* Jackhamer weighs only 14 lbs and can be used wherever *light weight* is of first importance. It handles easily on a scaffold or ladder and makes short work of holes for hangers, anchor bolts, pipe, conduit, dowels, and reinforcing rod. It is ideal for plug and feather work.

The "J-10" tears out brick work for doorways and windows or cuts anchors for girders and joists. It is used for chiseling and channeling and for vibrating concrete forms.

At last, here is a real Rock Drill—*air operated*—built for plant maintenance work. It is no longer necessary to use make-shifts. The "J-10" UTILITY Jackhamer is fast, powerful, easy to handle, has strong rotation and hole blowing and uses standard Jackbits. Buy a J-10 UTILITY Jackhamer to save TIME AND MONEY.

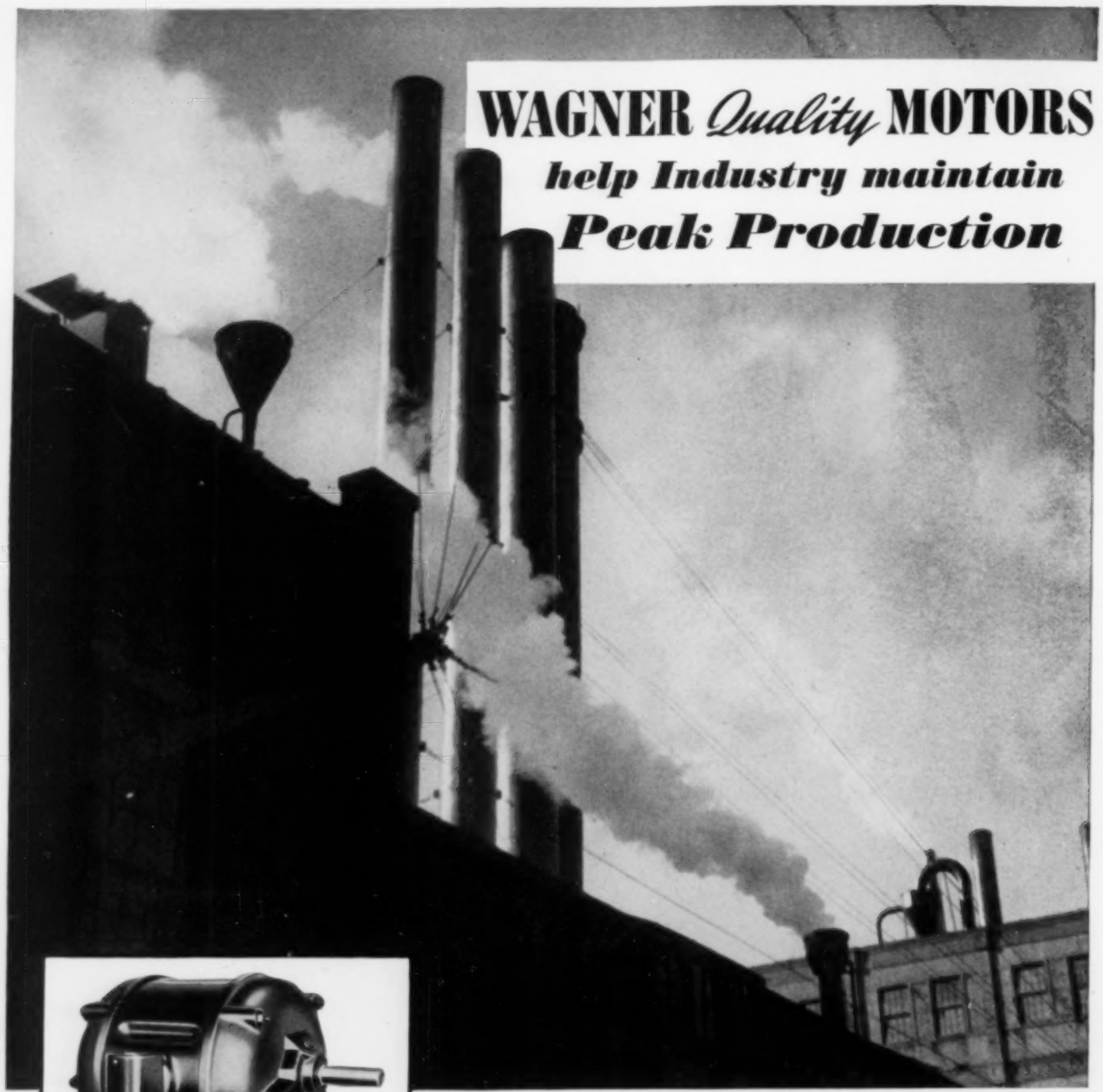
The "J-10" UTILITY Jackhamer is built by the world's largest manufacturer of Rock Drills and Compressors

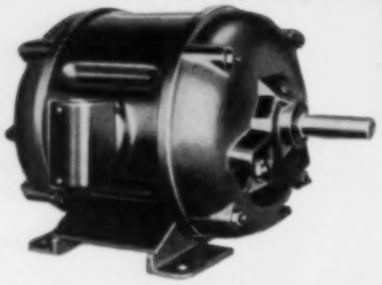


**Ingersoll-Rand**
11 BROADWAY, NEW YORK 4, N. Y.

29-5

# WAGNER *Quality* MOTORS help Industry maintain Peak Production



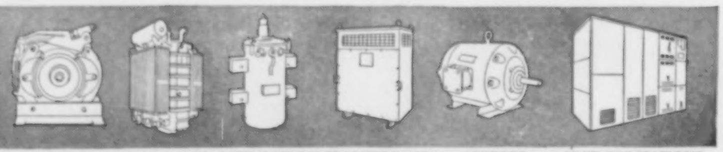


**Regardless of what your motor requirements may be—large motors . . . small motors . . . Wagner makes them all. The motor illustrated is typical of the Wagner line of polyphase and single-phase motors. Choose a Wagner motor for your next installation.**

Whistles blow, workers stop, and new shifts come on to the job, but motors driving production equipment must whirl merrily on around the clock to help industry maintain peak production. And peak production can be maintained only if motors stay on the job without breakdowns. Dependable motor performance is a tough assignment—but not so tough for Wagner Motors. They have the stamina to stand up because they are made of highest quality materials and are engineered to do the job efficiently. If you want motors that *will* do the job, whether large or small, contact any of our twenty-nine branches. They are located in principal cities and manned by trained field engineers who will help you solve your motor problems. A letter addressed to Wagner Electric Corporation, 6418 Plymouth Avenue, St. Louis 14, Mo., will bring Bulletins on the complete line of Wagner Quality Motors.

**Wagner**
**Electric Corporation**
EST. WE 1891

***Consult Wagner Engineers on all Electric Motor Problems***

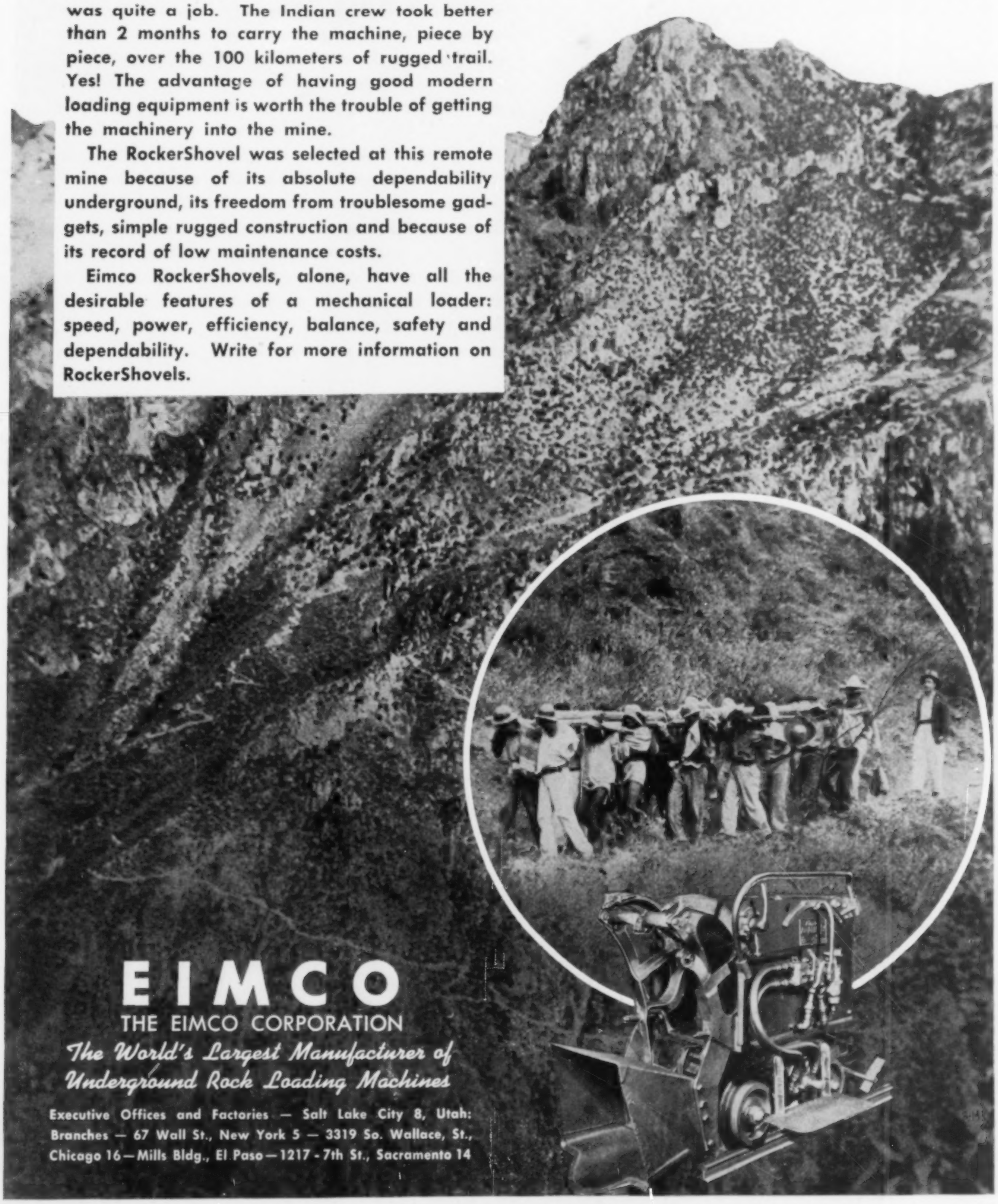


BRIDGE BRAKES · POWER AND DISTRIBUTION TRANSFORMERS · MOTORS · UNIT SUBSTATIONS

M47-23

**ELECTRICAL AND AUTOMOTIVE PRODUCTS**

# Packing in a RockerShovel



Remote and almost inaccessible mines use RockerShovels too! Packing in this Model 12B was quite a job. The Indian crew took better than 2 months to carry the machine, piece by piece, over the 100 kilometers of rugged trail. Yes! The advantage of having good modern loading equipment is worth the trouble of getting the machinery into the mine.

The RockerShovel was selected at this remote mine because of its absolute dependability underground, its freedom from troublesome gadgets, simple rugged construction and because of its record of low maintenance costs.

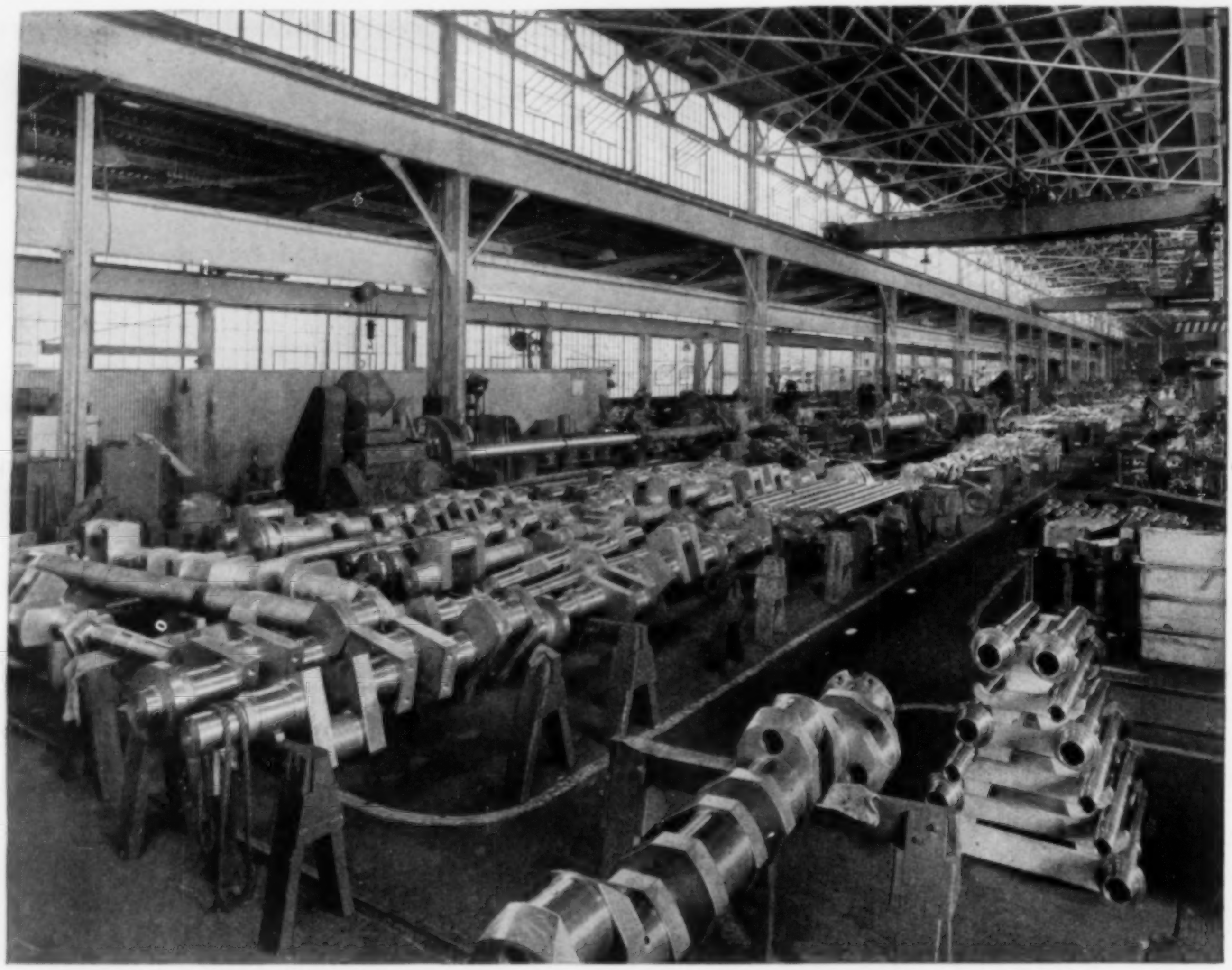
Eimco RockerShovels, alone, have all the desirable features of a mechanical loader: speed, power, efficiency, balance, safety and dependability. Write for more information on RockerShovels.

**EIMCO**

THE EIMCO CORPORATION

*The World's Largest Manufacturer of Underground Rock Loading Machines*

Executive Offices and Factories — Salt Lake City 8, Utah:
Branches — 67 Wall St., New York 5 — 3319 So. Wallace, St., Chicago 16 — Mills Bldg., El Paso — 1217 - 7th St., Sacramento 14



STEEL MAKERS
FORGESMITHS
HEAT TREATERS
MACHINISTS

## the Machining factor in "OK" steel forgings

● A steel forging—no matter how "clean" its steel, how expert the forgesmithing, or how careful the heat treating—is not a working piece of equipment until it is rough and finish machined. On such exacting parts as Diesel crankshafts, machinery spindles, periscope tubes and other heavy duty forgings, National Forge machining has long held high rank for the precision craftsmanship of its operators.

The National Forge machine shops are well equipped with modern machine tools, both large and small, in which a great range of work can be performed. In addition to the production of finished machined forgings, the equipment is also available for contract machine work. For this latter field of production a well set up assembly department has been established for the completion of assembled units. Why not know how much more National Forge can do for you now?

**National Forge**
**AND ORDNANCE COMPANY**
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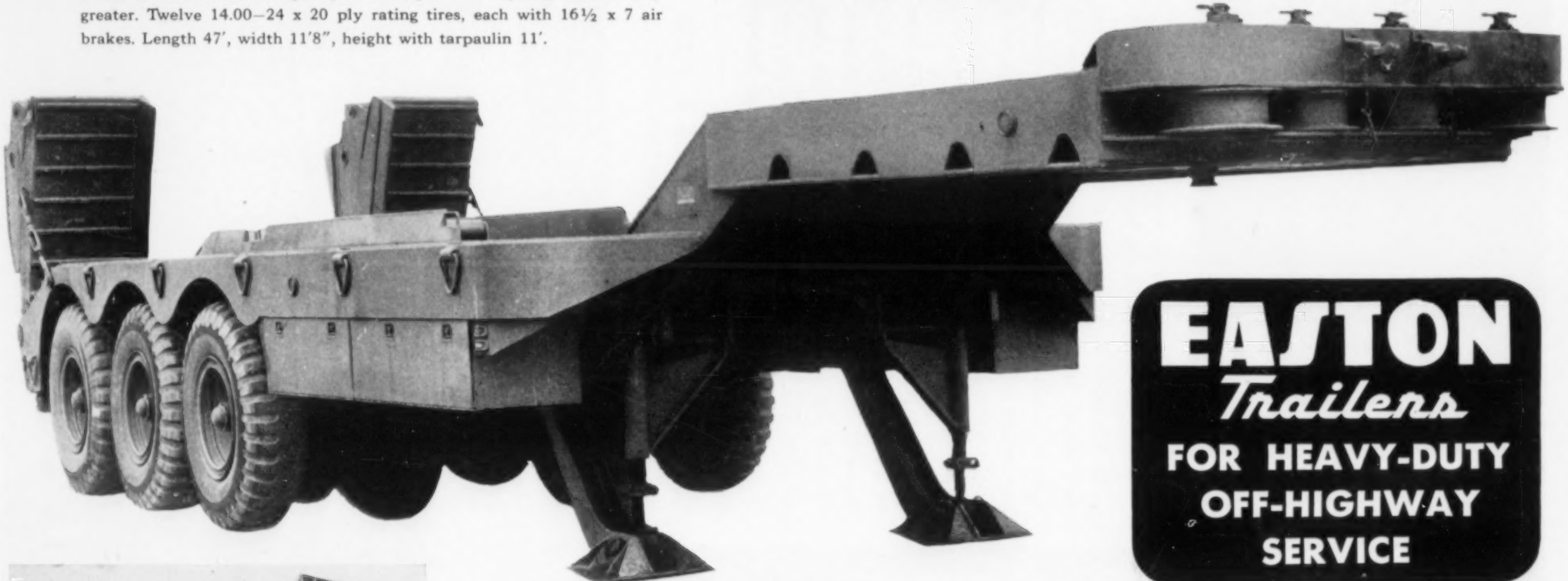

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# Compressed Air Magazine

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### ON THE COVER

COLUMBIA RIVER water impounded by Grand Coulee Dam will be pumped to a storage reservoir on higher ground to the east and then distributed through a canal system for the irrigation of farmland. One section of the Main Canal will be the $3,000,000, two-mile-long Davis Tunnel. Our cover picture shows what workers in the upstream end of the bore see when they emerge. On the far side of the 1000-foot coulee, which the water will cross in a siphon, the largest walking dragline ever used in the Pacific Northwest is excavating basalt along the canal line.

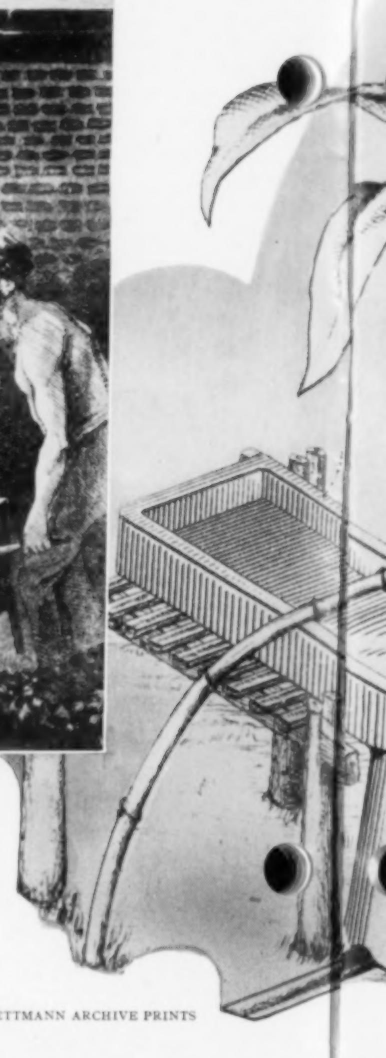
●

### IN THIS ISSUE

ONLY a few outstanding improvements in the blast furnace and its operation have been made during the six centuries this basic iron-making apparatus has been in use. Our first article tells of a development that may add to this limited list. It concerns a change in the blowing technique that increases a furnace's output of iron while reducing the cost per ton. After a year of experimenting under the new procedure, Republic Steel Corporation thinks so well of it that it plans to convert other furnaces to operate on the same principle.

●

RECENT developments in plastics manufacture and fabrication have given industry and the arts new and highly adaptable materials that are replacing or supplementing metals in many applications. In *From Music to Plastics* (page 167), the story is told of a plastics firm that got its start in an unusual way.



BETTMANN ARCHIVE PRINTS

# Teaching the Blast Furnace New Tricks

*C. H. Vivian*

THE PROMISE of a greater production of iron at reduced cost per ton with relatively slight changes in existing equipment is contained in a report by the Republic Steel Corporation on tests of a new method of operating blast furnaces. Known as "pressure blowing," the technique is based on an increase in blowing-air pressure above the level now considered normal, but with the pressure drop in the furnace kept about the same as under conventional procedure by throttling at the top to raise the discharge pressure of the gases.

Republic, in collaboration with Arthur D. Little, Inc., licensor of the process, has operated two furnaces under the revised conditions during the past year. The furnaces have produced 11-20 percent more iron than before and used 12 percent less coke per ton. In addition, the quality of the iron has been improved metallurgically, the furnaces have operated smoother, and other benefits have been noted. Republic plans to convert several more furnaces to pressure blowing, and all other major steel companies are watching the development closely. When it is considered that the nation produces some 66 million tons of iron annually and that the indicated saving by the new process is more than $1 per ton, the significance of the development is apparent.

To explain why the new system gives favorable results, it is necessary to consider briefly how a blast furnace functions. Iron ore, coke, and limestone are fed in at the top and compressed air is forced in at the bottom. The quantities of solid materials needed to produce a ton of iron vary with their metallurgical and physical characteristics, especially with the iron content of the ore. Assuming that the latter is 50 percent, the charge will be made up roughly of 4000 pounds of ore, 1600 pounds of coke, and 900 pounds of limestone—a total of around 6500 pounds. The air requirement will be approximately 8000 pounds, or 1500 pounds more than the total of the three other components.

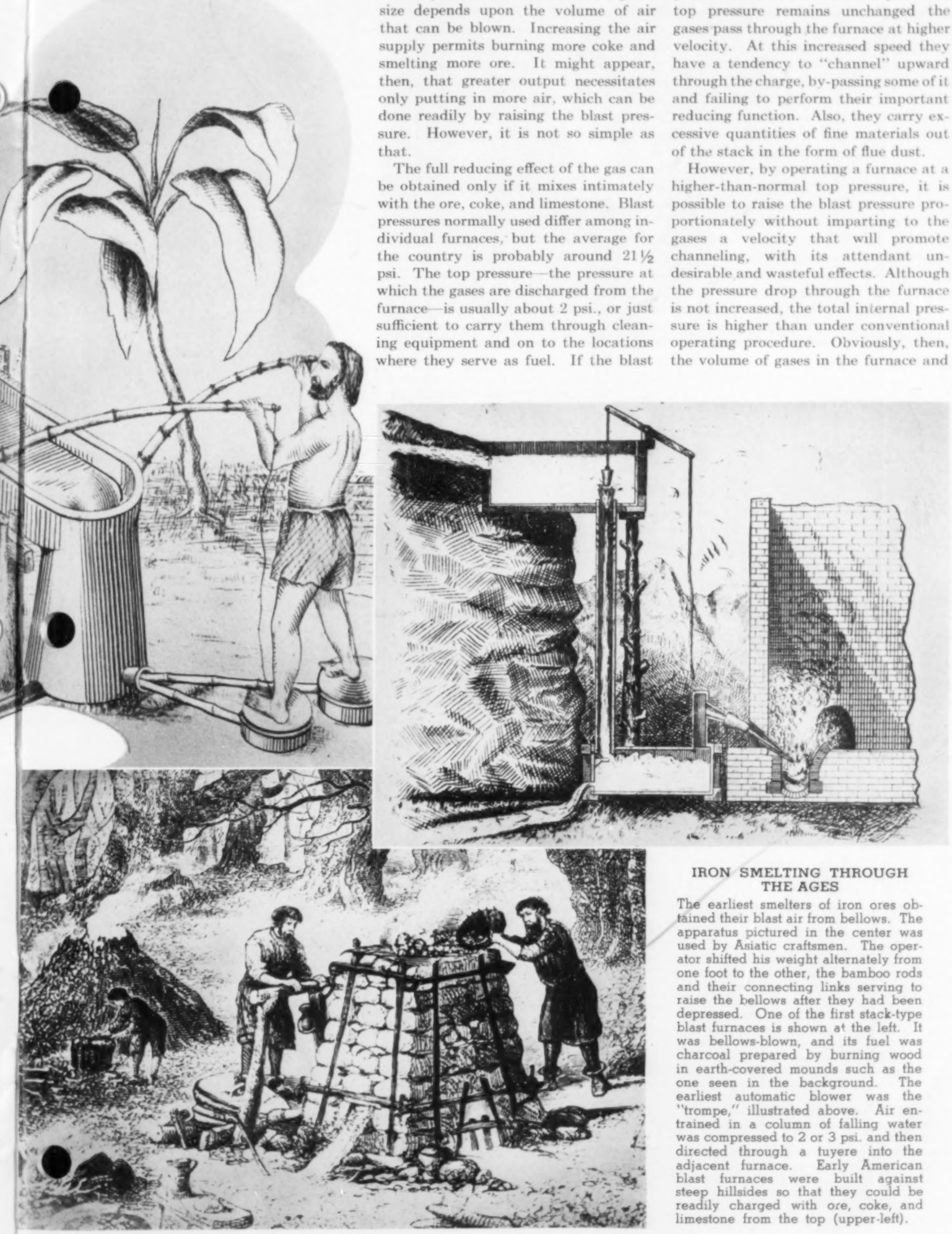
Introduced through tubes, or tuyeres, arranged around the base of the furnace, the air supports combustion of the coke to furnish the heat needed to melt the ore and convert its iron-oxide content into iron metal. Oxygen from the air first combines with carbon from the coke to form carbon dioxide, and almost immediately the latter combines with more carbon to make carbon-monoxide gas. The latter "reduces" the iron oxide in the ore. The limestone, which acts as a flux, is decomposed by the heat into calcium oxide and carbon dioxide. Part of the latter unites with carbon to form carbon monoxide, while the calcium oxide combines with the silica and alumina of the iron ore and ash of the coke to make slag. Molten iron and slag are drawn off at the bottom, the slag floating on top of the iron because it is lighter.

In general, the amount of iron that

can be produced in a furnace of a given size depends upon the volume of air that can be blown. Increasing the air supply permits burning more coke and smelting more ore. It might appear, then, that greater output necessitates only putting in more air, which can be done readily by raising the blast pressure. However, it is not so simple as that.

The full reducing effect of the gas can be obtained only if it mixes intimately with the ore, coke, and limestone. Blast pressures normally used differ among individual furnaces, but the average for the country is probably around 21½ psi. The top pressure—the pressure at which the gases are discharged from the furnace—is usually about 2 psi., or just sufficient to carry them through cleaning equipment and on to the locations where they serve as fuel. If the blast pressure is increased abnormally and the top pressure remains unchanged the gases pass through the furnace at higher velocity. At this increased speed they have a tendency to "channel" upward through the charge, by-passing some of it and failing to perform their important reducing function. Also, they carry excessive quantities of fine materials out of the stack in the form of flue dust.

However, by operating a furnace at a higher-than-normal top pressure, it is possible to raise the blast pressure proportionately without imparting to the gases a velocity that will promote channeling, with its attendant undesirable and wasteful effects. Although the pressure drop through the furnace is not increased, the total internal pressure is higher than under conventional operating procedure. Obviously, then, the volume of gases in the furnace and



IRON SMELTING THROUGH THE AGES

The earliest smelters of iron ores obtained their blast air from bellows. The apparatus pictured in the center was used by Asiatic craftsmen. The operator shifted his weight alternately from one foot to the other, the bamboo rods and their connecting links serving to raise the bellows after they had been depressed. One of the first stack-type blast furnaces is shown at the left. It was bellows-blown, and its fuel was charcoal prepared by burning wood in earth-covered mounds such as the one seen in the background. The earliest automatic blower was the "trompe," illustrated above. Air entrained in a column of falling water was compressed to 2 or 3 psi. and then directed through a tuyere into the adjacent furnace. Early American blast furnaces were built against steep hillsides so that they could be readily charged with ore, coke, and limestone from the top (upper-left).

**HIGH-PRESSURE-BLAST LABORATORY**

One of two Republic Steel Corporation blast furnaces that have been operated for a year under blast pressures ranging up to 30 psi. and top pressures up to 12 psi. This one is No. 5 Furnace at Cleveland. It is almost 109 feet high, has a hearth diameter of 27 feet, and a working volume of 44,346 cubic feet. Blast air is fed into it through eighteen tuyeres arranged around its base.

the volume of blast air blown can be increased. The greater air supply feeds in additional oxygen, which burns more coke and smelts more iron.

Comparatively minor changes are required in an existing furnace to permit operating it under higher pressure. A throttle valve with suitable control apparatus is needed to regulate the top pressure, some alterations have to be made in the bell and hopper through which solid materials are charged, and the primary gas-cleaning equipment has to be modified so that it will function at the greater top pressure. These changes, and other smaller ones, can be made in a few days and at a cost ranging from $70,000 to $150,000. If new turboblowers have to be purchased to meet the altered blast-air conditions, the conversion expense may go as high as $1,500,000, but even this is relatively small compared with the sum of $6,000,000 required to build a modern 1200-ton-per-day furnace.

Patents on this method of blast-furnace operation are held by Arthur D. Little, Inc., an industrial and chemical engineering firm of Cambridge, Mass., which is prepared to grant licenses to all steel companies desiring them. The patents were originally granted to Julian M. Avery, now a New York consulting engineer, who assigned them to Arthur D. Little, Inc. He became interested in the problem in a rather unusual and incidental way while directing some metallurgical operations in Norway for the Union Carbide & Carbon Corporation. To utilize surplus power, it was decided to smelt iron ores in electric furnaces. After this work had been underway for some time, Mr. Avery began wondering how their efficiency compared with that of conventional blast furnaces. In attempting to determine this point, he strayed along a bypath of research that eventually led to the top-pressure theory. Afterward he became identified with the Little group, where his investigations were continued. His former employer, Union Carbide & Carbon Corporation, owns the foreign rights to the use of the process.

Mr. Avery began his work in 1936, and by the time the United States became involved in the war his theories were pretty well crystallized. Once we were in the conflict, demands upon American producers of war matériel increased tremendously, and it was evident that they could not be met unless basic iron could be made at a much accelerated rate. The Government became interested in pressure blowing because it seemingly offered a way by which the iron output could be considerably augmented without expensive and time-consuming expansion of existing blast-furnace facilities.

It was therefore decided to try out the method under full-scale operating conditions, and the War Metallurgy Committee selected Republic Steel Corporation's No. 5 furnace at Cleveland, Ohio, for that purpose. This furnace, which was built during the early war period by the Defense Plant Corporation, has a hearth diameter of 27 feet and a rated capacity of 1275 tons of iron a day under conventional practices. The tests were run for four months in 1944 under the direction of Prof. T. L. Joseph of the University of Minnesota, and were stopped by abnormal erosion of the big bell that prevented it from sealing properly. During this trial period, the daily production reached as much as 1420 tons, compared with a maximum of 1170 tons under previous normal-pressure operation and with no change in ores. The volume of air blown was gradually increased from the usual 75,000 cfm. to a peak of 110,000 cfm. and was maintained at more than 100,000 cfm. for a duration of two weeks. The top pressure ranged as high as 10 psi.

When the mechanical difficulties were encountered the furnace was returned to normal-pressure operation, and the war ended before any additional high-pressure experiments could be carried out. With a decline in the demand for steel imminent, Republic terminated its lease on the furnace and turned it back to the DPC. However, some of Republic's personnel had meanwhile been intrigued by the increase in output registered during the test period and wanted to explore further the possibilities of high-pressure blowing. With this in mind, Republic sought a license from Arthur D. Little, Inc., to apply the new method to Republic's No. 3 furnace at Youngstown, Ohio. Permission was granted, and plans were made to convert the furnace accordingly. Then, early in 1946, when a national shortage in pig iron developed, Republic re-leased No. 5 Cleveland furnace and obtained a license to operate it also under increased pressure.

The Youngstown furnace was blown in on June 21, 1946, and the Cleveland unit on July 5. During the first month the volume and pressure of the blast air were brought up to the previously established maximum and held there for a few days. They were then increased, little by little, with accompanying throttling at the furnace tops to raise the discharge pressures progressively. Both furnaces have since been operating under the higher pressures, affording the Republic staff and collaborating technicians from the Little organization an opportunity to gather data on the effectiveness of the new scheme.

At Cleveland, an average daily production of 1430 tons of iron has been obtained over periods ranging up to more than a month, representing an increase of 260 tons over the 1170-ton average under normal-pressure operation. The blast pressure has ranged as high as 30 psi. and the top pressure up to 12 psi. Compared with the established maximum blast volume of 75,000 cfm., the air blown has reached a peak of 120,000 cfm., which is believed to be the greatest volume ever put into a furnace. Throughout the tests the furnace has been run on a straight "burden" of Lake Superior ores, meaning that no sinter or scrap has been added to "sweeten" the charge and thereby increase the yield of iron.

The Youngstown furnace, which is

rated at 1120 tons a day but normally produced 960 tons, has had an output of 1180 tons over a period of four months under the new conditions. Its burden, consisting of Lake Superior ores with some sinter to bring the average iron content up to 49 percent, has been the same as before. The blast pressure has exceeded 28 psi. and the top pressure 9 psi. The volume of air blown has been up to 80,000 cfm., as compared with the 67,000 cfm. maximum under normal-pressure operation.

The coke rate, that is, the quantity of coke charged per ton of iron produced, decreased at Cleveland from 1750 pounds (normal) to 1495 pounds during one month and to 1635 pounds during another, representing a saving ranging from 115 to 255 pounds. At Youngstown the reduction was from 1705 to 1485 pounds. At Cleveland, the escaping flue dust was weighed. A comparison with previous figures shows that it decreased in one period from 215 to 145 pounds per ton of iron and in another from 270 to 170 pounds, or 70 and 100 pounds, respectively. At Youngstown, where it was necessary to make an estimate, a reduction of from 280 to 240 pounds was indicated.

In addition to these direct savings, there are other benefits. For one thing, the decrease in the amount of coke required results in an iron of lower sulphur content because coke is the principal source of sulphur in a blast furnace. A second advantage is smoother furnace operation. Under conventional practice, as has been noted, an increase in the volume of air blown increases the pressure drop in a furnace and causes hanging and slipping of the charge, producing a "rough" furnace. By the new method, as we have seen, higher blast pressure does not increase the pressure drop. As a matter of fact, it has been found that when the top pressure is raised, it is not always necessary to raise the blast pressure a like amount. For example, to operate at a top pressure of 10 psi., or 8 pounds above normal, the blast pressure needs to be increased by from 6 to 9 psi., depending upon conditions. This means that for a good part of the time the pressure drop is actually lessened instead of increased. As this causes a reduction in the velocity of the gases passing through the furnace, the operating characteristics are improved.

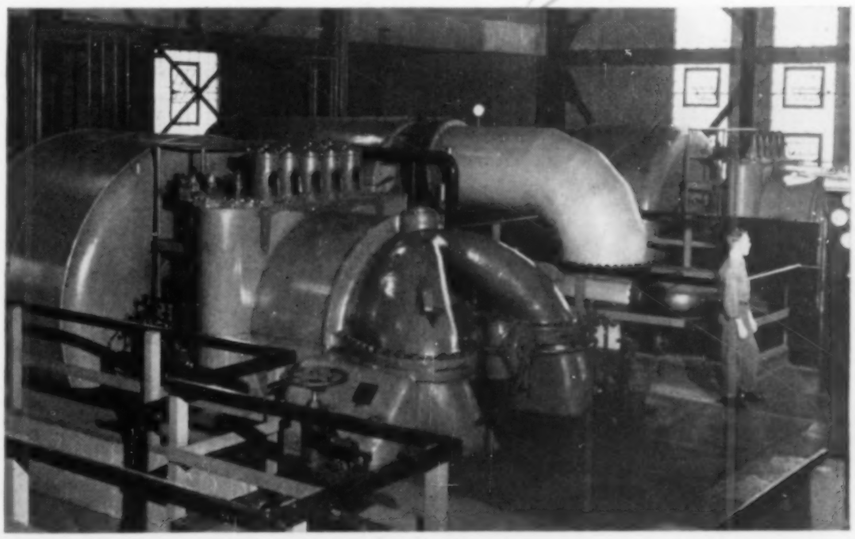
Savings of as much as $1.30 a ton in the cost of producing iron have been realized during the Cleveland and Youngstown tests. Most of this economy is attributable to the cut in coke consumption, a fact that has special significance in view of the rapidly diminishing supplies of high-quality coking coal. A large blast furnace uses about 1000 tons of coke daily, and inferior grades contain impurities that must be removed at some expense. Coke conservation is therefore an important item.

The demonstrated capacity of the new technique to reduce flue dust is likewise of considerable value because the imminent exhaustion of high-grade Lake Superior iron ores will leave a large percentage of our steel producers dependent upon lower-grade ores that are unusable as mined. To raise their iron content they must be concentrated, and this involves grinding. Heretofore it has been considered necessary to agglomerate the concentrate to permit smelting without high losses in flue dust, and no good way has been found to do this economically. In reporting on the Republic tests before the Iron and Steel Institute at New York in May, J.H. Slater, assistant manager of the corporation's Cleveland district, said, "All blast furnace men should ponder the effect that pressure operation, with its demonstrated control of flue dust production, will have on the utilization of fine ores and ore concentrates in the blast furnace. Pressure operation may well alter many of our ideas with respect to ore beneficiation."

The demand the new method promises to create for turboblowers that can supply large volumes of air at high pressure is, in reality, only a further manifestation of a trend that began with the outbreak of World War II. Thirty years ago, when American steel production mounted sharply to meet the requirements of World War I, the largest blowers available had capacities of 50,000 to 60,000 cfm. at pressures of 30 psi. Expansion of steelmaking facilities continued during the lush postwar era, with maximum blower sizes keeping pretty well within these limits. Few blowers were manufactured during the 1930 depression decade, but the prewar industrial revival that began about ten years ago ushered in a period of unprecedented steel tonnages that greatly stimulated the demand for blowers.

Once we were in the war, these sources of "wind," as steel men call blast air, became vital equipment, and the War Production Board took steps to insure an unfailing supply for steel plants not only in this country but also in some of the nations with which we were allied. To this end, it delegated the job of building all blast-furnace blowers to Ingersoll-Rand Company, which had long maintained leadership in this field. To accelerate production, a great many blowers were made of one standard size that would meet the conditions in most plants. This machine was designed to deliver 90,000 cfm. of air at 30 psi.—enough, plus some reserve, to serve the new blast furnaces, most of which were rated at 1000 or more tons of iron daily.

Many blowers of other sizes were also constructed, and some of them were of unprecedented capacity. Eleven units, each of which can supply 125,000 cfm. at 30 psi. pressure, were sent to Russia. Reports on their service conditions have been meager, but it is believed that they are being operated within the range of 90,000 to 100,000 cfm. One of the same size was furnished for use in the Birmingham, Ala., district. The ores there are more "sticky" than the Lake Superior variety and tend to bridge in the blast furnace. To overcome this, blast pressures are maintained at a higher level than the average of 21½ psi. previously given for the country, and they sometimes reach up to 30 psi. Top pressures, however, are essentially the same as elsewhere. New wartime steel plants were built at Geneva, Utah, and Fon-



**TURBOBLOWERS AT CLEVELAND**

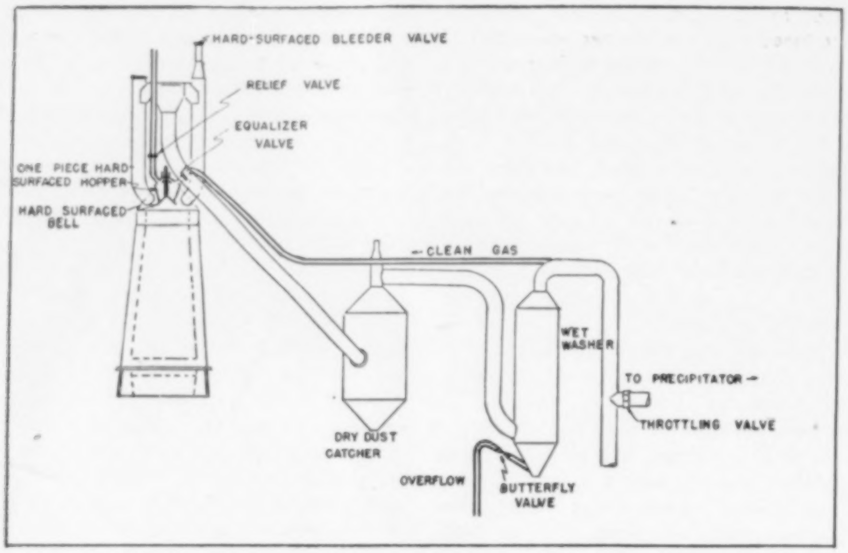
Put in during the war period, each of these two machines will deliver 90,000 cfm. of air at a pressure of 30 psi. Each consists of a 4-stage blower driven by a 12-stage, 10,000-hp. steam turbine. To provide the higher volumes and pressures needed under the new technique, the two units are operated in series, with an intercooler between them.

tana, Calif., and as it was not known how the ores and other charge components would behave in the blast furnaces, blowers with ample reserve volume and pressure were ordered. Those at Geneva deliver 95,000 cfm. at 35 psi. The two units at Fontana deliver 100,000 cfm., one at 35 psi. pressure and the other at 30 psi.

For use in the Republic tests there was available at Youngstown an Ingersoll-Rand blower of 90,000 cfm. capacity at 35 psi. pressure. At Cleveland, the required volume and pressure are being obtained by operating in series two of the "standard" wartime units with a 90,000-cfm. and 30-psi. rating and with an intercooler between them.

Encouraged by the savings and benefits thus far obtained, Republic will proceed with its research. To permit increasing the blast pressure above the limits of the existing equipment, the corporation has ordered from Ingersoll-Rand Company two turboblowers that will be capable of delivering 125,000 cfm. of air at 40 psi. pressure. The largest of their type ever to be built, these machines will each push 6900 tons of air into a blast furnace in a day. In addition, Republic is purchasing another I-R blower with a volume and pressure of 90,000 cfm. and 35 psi., respectively, for its Buffalo plant.

Concerning the possibility of greater production economies in the realm of still higher pressures yet to be explored, Mr. Slater wrote in the paper previously referred to: "The fact that iron production in the blast furnace increases as a direct function of the wind blown makes it clear that pressure operation offers the opportunity of greatly increased iron tonnages as blower sizes are enlarged. Thus, the increases of 11-20 percent in iron output thus far achieved will be small compared with that possible as new 125,000 cfm. blowers now on order are received."



**BLAST-FURNACE ALTERATIONS**
Diagram showing the principal changes that are required in a blast furnace and its accessories to permit operating at high pressure.

**J. H. SLATER**
Assistant manager of the Republic Steel Corporation's Cleveland district and director of the experiments in high-pressure blast-furnace operation now underway.

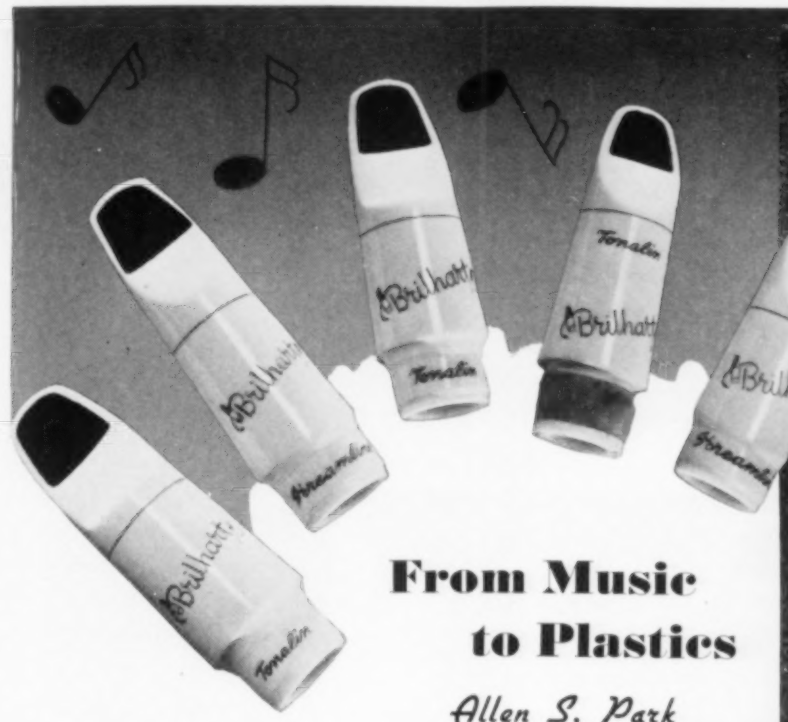
In this connection it is pertinent to note that Mr. Avery's original conception of the new method was to operate furnaces under a pressure of several atmospheres. The practical effects of these higher levels are yet to be ascertained, but it is conceivable that the blast furnace of the future may be a relatively small, high-pressure vessel into which ore, coke, and limestone will be charged in a continuous stream instead of intermittently, as is now done.

This promise of greater iron production per furnace is especially important just now because of the relationship it bears to other matters. Ordinarily, blast-furnace iron is combined with an equal amount of scrap iron or scrap steel to make steel in open-hearth furnaces. However, there is a current scrap shortage that has caused its price to soar. If the output of blast furnaces can be augmented, then less scrap will be required. Recent experiments indicate that open-hearth steel production can be increased by fortifying the oxygen content of the combustion air; and with the advent of less expensive processes for making oxygen, this gas may be extensively used for that purpose in the near future. In that event, there would be need for more pig iron than blast furnaces can currently supply. All these developments are, of course, largely contingent upon the continuation of the present high industrial demand for steel.

A potential beneficiary of the new blast-furnace technique is the iron-founding industry, which is dependent upon steel plants for its supply of pig iron. Ten percent of the output of blast furnaces normally goes into cast-iron products, many of which are badly needed today for additional housing. However, because so much of the iron now goes to the open hearths for making steel, the foundries are hard pressed to get all they require. Greater iron production would solve their problem.

The high-pressure technique may turn out to be one of the few important improvements in the blast furnace since that basic apparatus was introduced six centuries ago. The blast furnace originated in the Rhine provinces of Europe in the fourteenth century as an outgrowth of earlier equipment. It used charcoal for fuel, and its first increase in efficiency came with the substitution of coke. Little further betterment in its performance was registered until 1829, when J. B. Nielson discovered that fuel consumption could be reduced greatly by heating the blast air. Another improvement was the sealing of the furnace top and the utilization of the discharge gases, which had been wasted. In this connection it has been suggested that it may be possible under high top-pressure operation to recover substantial quantities of power from the discharge gases.

The final noteworthy blast-furnace development was the introduction of compact, high-speed turboblowers to replace the ponderous reciprocating blowing engines that were in common use even as late as the turn of the century. Aside from these things, the only significant change has been a marked increase in the size of blast furnaces. Just how recently this transpired may be judged from the following passage in a textbook on iron and steel published in 1918: "Ninety feet is the most economical height of furnace, and the best run is a daily output of 400 tons of iron."



# From Music to Plastics

*Allen S. Park*

The Story of Arnold Brilhart, Ltd., a Business Founded on a Pet Peeve of Saxophone Players

MOUTHPIECES AND REEDS

Arnold Brilhart started out to make a better mouthpiece for his own saxophone and now finds himself head of a concern that manufactures them for a fair share of the nation's woodwind players. Five models of his product are shown above, left. The one in the center is for a clarinet; the others are for saxophones. Plastic reeds, designed to end the agonies of musicians who have always been bedeviled by the frailties of wooden reeds, taper to a thinness of as little as three-thousandths of an inch. To give them the familiar feel of natural reeds to the tongue they have minute striations. Some players bite the upper side of the bit. In the Brilhart mouthpiece this is made as an insert that can be replaced.

IF SAXOPHONE and clarinet players were not fussy about the mouthpieces of their instruments, the plastics manufacturing firm of Arnold Brilhart, Ltd., would not be in existence. In fact, it would never have come into being had not Arnold Brilhart himself been one of the fussiest of these musicians. As things are, the company is turning out each year some $300,000 worth of precision-built plastic mouthpieces and accessories, but these articles now make up only about a fifth of its total production. The techniques that were developed in learning how to make mouthpieces have been applied to manufacturing other plastic articles, and their number and volume are growing all the while. Some of these products are Brilhart-designed and owned, while the rest are made on a custom basis for a select list of clients. The story of how this all came about is a romantic business tale that rivals the creations of the Hollywood scenarists.

In 1939, Arnold Brilhart, then 36, was recognized as one of the leading saxophone players on the nation's air shows. His services were in such demand that he was appearing on as many as eighteen New York programs a week. His earnings averaged more than $100 a day. Like others of his profession, Brilhart was extremely particular about his mouthpieces. As an accompanying illustration shows, the tapered end of this element—the end that goes into the mouth—has a reed on the underside. This reed is clamped at its forward end, at about the center of the mouthpiece, and extends backward under a channel between the side rails of the mouthpiece. The amount of space between the reed and the channel, which depends upon the curvature of the edges of the side rails, is very important to a saxophone player, but it is a matter of individual choice.

Professional players are proverbial shoppers for mouthpieces that will exactly suit them. For some years following the invention of the saxophone by Adolphe Sax the mouthpiece was made of brass or wood, but at the time Brilhart interested himself in the problem it was commonly machined or molded from hard rubber. This material has drawbacks because it is affected by changes in temperature, and even a slight variation in the curvature referred to is immediately noticed by a good player. It may affect his playing or, in any event, he is fearful that it will, and that makes him nervous and worrisome.

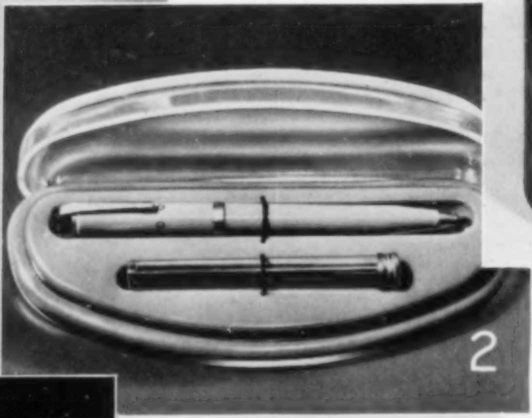
This critical contour was one phase of the mouthpiece problem that Brilhart tackled. The other phase was the reed, which has always been a prime annoyance to saxophone and clarinet players. Traditionally used reeds of wood come from France, but they seldom suit the musician as they are received. He is always shaving and scraping the thin strip down thinner, or trimming its business end, or adjusting its position. Even then he seldom gets it just the way he wants it.

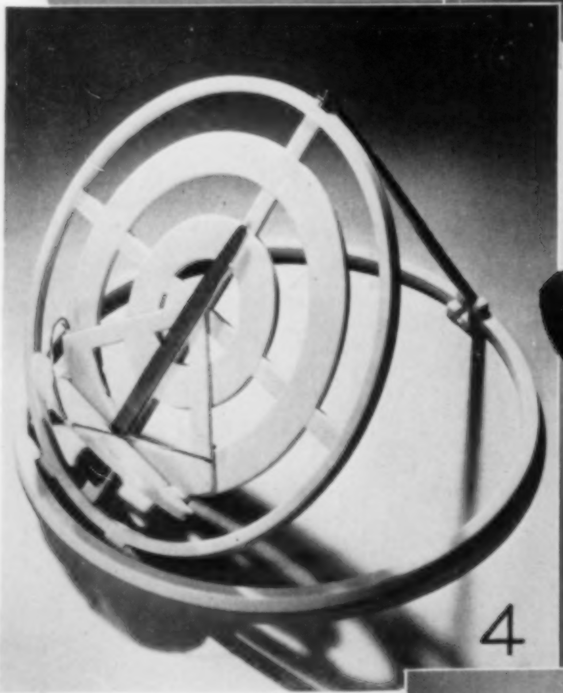
An orchestra leader will tell you that right up to the time he raises his baton for any number, the saxophone and clarinet players are invariably tinkering with their mouthpieces. Even when a player finally becomes satisfied with the reed, his worries aren't over. For this thin strip is extremely fragile and isn't protected while on the instrument. One careless movement, or a jostle from a neighbor, and it may brush against the musician's coat and then all his painstaking pottering has gone for naught. Then he starts all over with another reed.

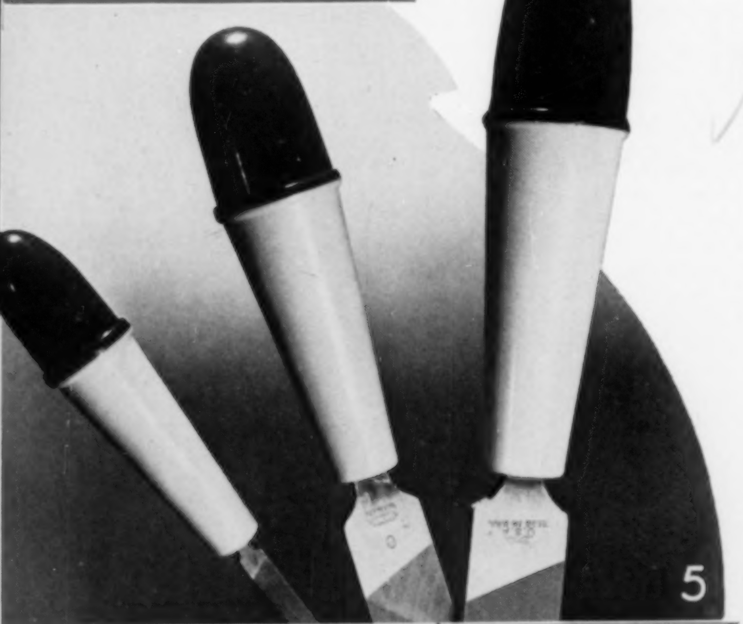
For years, Brilhart did his share of fuming over these things, and then one day he decided to see what he could do

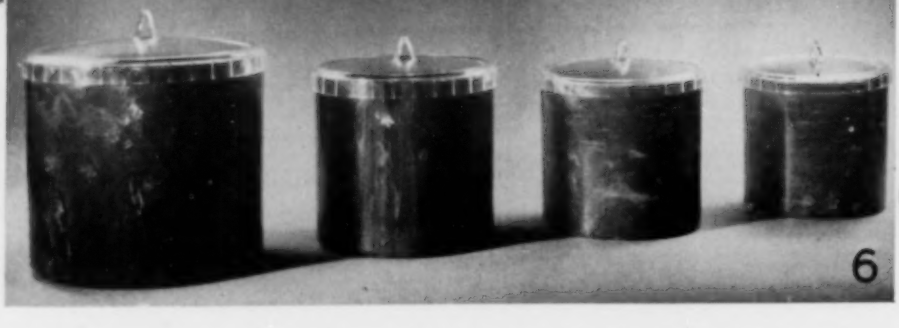
## BRILHART PRODUCTS

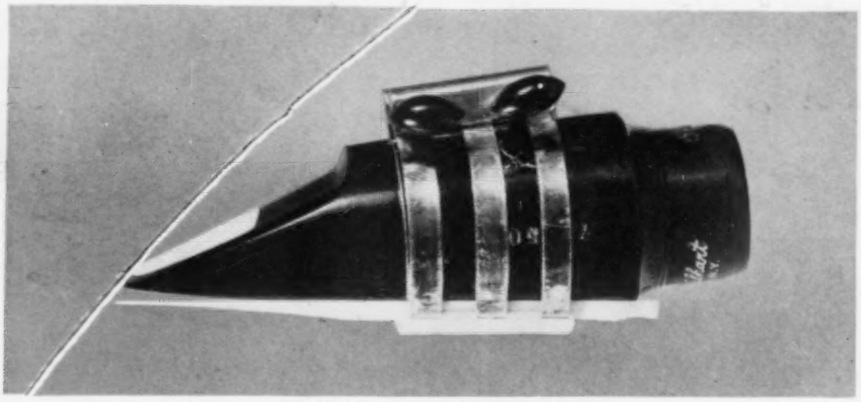
Examples of distinctive plastic articles, many of which are made in brilliant color combinations. 1- A bucket that will hold ice cubes in frozen condition for 48 hours. 2- A mechanical pencil containing six different-colored leads, any one of which can be selected by turning the clip to a like-colored dot on the barrel. 3- A vari-colored lamp with a body built of plastic rods and a base of laminated wood. 4- An adjustable book rest for reading in bed. 5- Nonbreakable file handles. 6- Canisters for storing flour, sugar, etc., in the kitchen. These products are marketed by the Ross-Frederick Corporation, a subsidiary that was formed so the Brilhart name, well known among musicians, could be identified exclusively with the mouthpieces of woodwind instruments.











THE CRITICAL CURVE

A Brilhart saxophone mouthpiece in the position it assumes when the instrument is being played. The contour of the left underside is of vital importance, as it determines the spacing between that surface and the white plastic reed. By finding a material that retains the curve under varying temperature conditions Brilhart laid the foundation of the business he now heads. Mouthpieces with ten variations of this curve are available and, in combination with plastic reeds of differing thicknesses, afford musicians a wide range of choice. Each bears a serial number and is registered in the owner's name, thus simplifying the ordering of duplicates. The company has a display room in a New York City building that is frequented by musicians where they can try out different mouthpieces and reeds until they find exactly what they want.

to improve the situation. Pondering the problems involved, he thought they might be solved with modern plastics. He was aware of the advances made in the plastics field, but he had no special knowledge of that industry. Neither had he any technical education or training. Nevertheless, he began gathering information wherever he could and set up a small hand-operated plastics press in the basement of his home. There he patiently experimented in his spare time, and one day he succeeded in turning out a mouthpiece to his liking. Up to then, this had been his only objective. The idea of going into the business was to come later.

Brilhart used his mouthpiece and exhibited it to fellow musicians with no little pride. They examined it with approving eyes and invariably asked him if he would make one for them. He did this for Artie Shaw, Jimmy Dorsey, and other well-known woodwind players, and all of them seemed to like his mouthpieces better than those they had been using. News of his new product spread by word of mouth, and requests for it increased. It was then that he decided to begin making the mouthpieces for sale. The first ones were placed on the market in 1939.

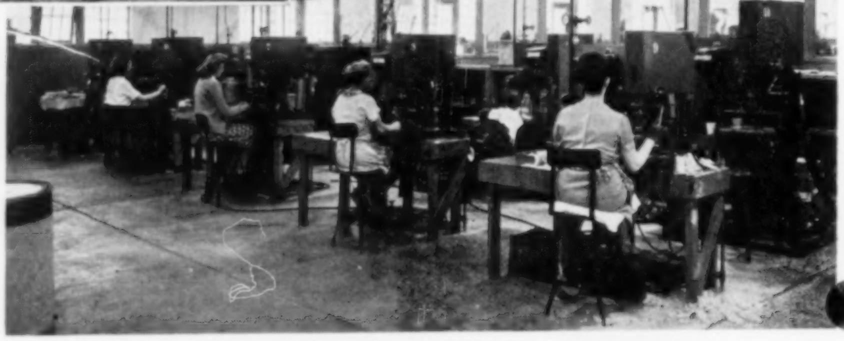
During the early experimental period, Brilhart had relied entirely upon his wife and his close friends for help. Prior to their marriage in 1933, Mrs. Brilhart was a well-known harpist, Verlye Mills, so she well understood the need for a better mouthpiece. Among associates who assisted in the cellar workshop was Clark Galehouse, a fellow saxophonist who had played with high-ranking popular orchestras. He had studied engineering at Drake University, Iowa, but had embarked upon a musical career by preference. When orders for the mouthpiece necessitated an increase in production facilities, the workshop was expanded to three rooms. Brilhart had to decide between music and plastics, and chose the latter. Supervision and paid help were required to put the business on a substantial basis, so Brilhart prevailed upon Galehouse to cast his lot with him. Today, at 37, Galehouse is vice-president and general manager of the company. He has severed all his former professional musical connections. Brilhart, largely for sentimental reasons, still plays on one radio program weekly —the "Mr. District Attorney" show on Wednesday nights.

All the while they were working on the mouthpiece, Brilhart and his associates were also trying to make a serviceable plastic reed, but it was a slow job. Many musicians told them they were wasting their time, but in the end they succeeded. The trick was to produce a paper-thin end section that would duplicate the performance of the wooden reed. Even after they accomplished this they had to overcome professional bias. To help do this, they put striations on the surface to make it feel like a wooden reed in the musician's mouth.

When the 3-room workshop was outgrown in 1943, a factory with 12,000 square feet of floor space was established at Great Neck, Long Island. This was enlarged once, but soon again became too small, and last November operations

FINISHING MOUTHPIECES

A separate department (right) is devoted to finishing mouthpieces. Three machining operations are performed on them along the left wall, after which they are sanded and polished, also by machine. Then they go to the tables at the right to undergo hand treatment by skilled workers. The woman shown above is removing burrs left by one of the machining operations. The head of this department is a saxophone player.



**MOLDING**

The operator of the 12-ounce Lester hydraulic machine shown at the left is holding a cluster of four 2-inch camera lenses that he has just removed from it. Granular thermoplastic material is metered from the hopper above the man into a cylinder beneath a vertical plunger. The latter, exerting a pressure of 20,000 psi., forces it into a chamber, where it is plasticized by electric resistance-type heaters. Each new charge pushes the preceding and now fluid one ahead of it and through a nozzle that leads at a right angle into a water-cooled mold cavity, which is behind the safety screen above the bucket. The mold jaws are held closed by a force of 350 tons. After a predetermined time lapse, the mold automatically opens and the molded part is ejected. Smaller injection-type machines (above) are actuated by compressed air through the medium of two cylinders on each. Intricate electrical parts containing metal inserts are made in compression-transfer presses where the plastic is heated to the fluid state in a transfer chamber and then forced into a mold where it flows around and embeds the previously placed inserts. In the view at the top-right an operator is pumping up the hydraulic pressure of such a press by hand. The product being made is a comb-like piece in which the teeth are seventeen brass inserts. Some are shown in the box in the foreground.

were moved to a plant at Mineola, Long Island, that consists of ten buildings with approximately 60,000 square feet of floor area. There are now 260 employees. Meanwhile, in 1943, the business was incorporated. The name, **Arnold Brilhart, Ltd.**, smacks of British terminology, but has no special significance. The "Limited" was put in by Brilhart just because he liked the sound of it.

Although the venture was launched to make mouthpieces, other products were added before long largely through force of circumstances. The exigencies of war called for plastic parts for many instruments and devices used by the armed services. Some of these were hard to make, and the Government was eager to place work with manufacturers who were willing to tackle the problems involved. Having licked the mouthpiece stumbling block, the Brilhart organization had acquired a bit of a reputation. Soon it began receiving requests to make this or that for Uncle Sam.

With their limited experience and technical knowledge, Brilhart and Galehouse hadn't yet fully comprehended the difficulties of design and fabrication that lurked in some of these products. In their innocence they agreed to manufacture certain of the parts, unaware of the fact that they had already been looked over and turned down by some of the long-established plastics fabricators. It was a case of ignorance being bliss. They went ahead on the theory that all plastics jobs were hard, but that they could be solved by patience and persistence. This proved to be a good formula, for it continued to bring success, just as it had in the case of the mouthpiece.

Each assignment that they mastered brought them others, and throughout the war period they turned out parts for vital equipment. Some of these went into complicated machines for making aircraft statistical computations. Others were incorporated in electronic devices that were being manufactured by Bell Telephone Laboratories, Western Electric Company, and General Electric Company. Among them were connectors with inserted pins and small wires that had to be made to tolerances of one ten-thousandth of an inch. They produced 30,000 delicate sighting tubes with fine cross hairs for the Navy, and did the job so well that they were asked to furnish 60,000 more.

Each of these commitments involved its quota of headaches, but it also built up experience and bolstered confidence. With the war over, various industrial concerns that needed plastic parts for products brought their problems to the Brilhart firm, and in that manner it acquired its custom business. Most of the articles that come under that head are things that one or more other plastics manufacturers did not care to undertake. They range from tiny nylon parts for the textile industry to intricate moldings with metal inserts for electrical and electronic instruments. One of the leading items is camera lenses that are made to very close optical tolerances and that require no grinding or polishing prior to use. These differ in size and are both round and rectangular in shape, the latter ranging up to 2 inches square and serving as view finders.

Plastic lenses are considerably cheaper than those of glass. To avoid scratching them, their faces are touched only by girls with absolutely clean hands. Molders and finishers handle them only by the edges. It takes several months to master the technique of molding perfect large lenses. Here, again, the solution was found by keeping at it day after day until the reasons for failure were determined and corrective measures were worked out. Other quantity products are watch crystals and bases and barrels for inkwell desk sets.

Meanwhile, the list of proprietary items has been expanded through careful research and selection. The aim of the plant is to limit production to articles for which there is or will be sufficient demand to insure a relatively steady flow of work. This is in line with the company's guiding policy of making only high-quality products, and stems from the conviction that irresponsible manufacturers have given the infant plastics industry doubtful standing with the public. Too many inferior plastic articles have been turned out just because they could be sold to inexperienced buyers at a profit. Either they were poorly designed, the wrong materials were chosen to permit of mass production, or they should not have been made of plastic at all. The Brilhart contention is that plastics should not serve as a substitute for other materials, but should be confined to uses where they have definite advantages. It is also deplorable that much of the public's impression of plastics has been gained from carelessly fashioned toys, novelties, and gadgets which are devoid of the careful designing and accurate molding that characterize plastics entering into industrial products.

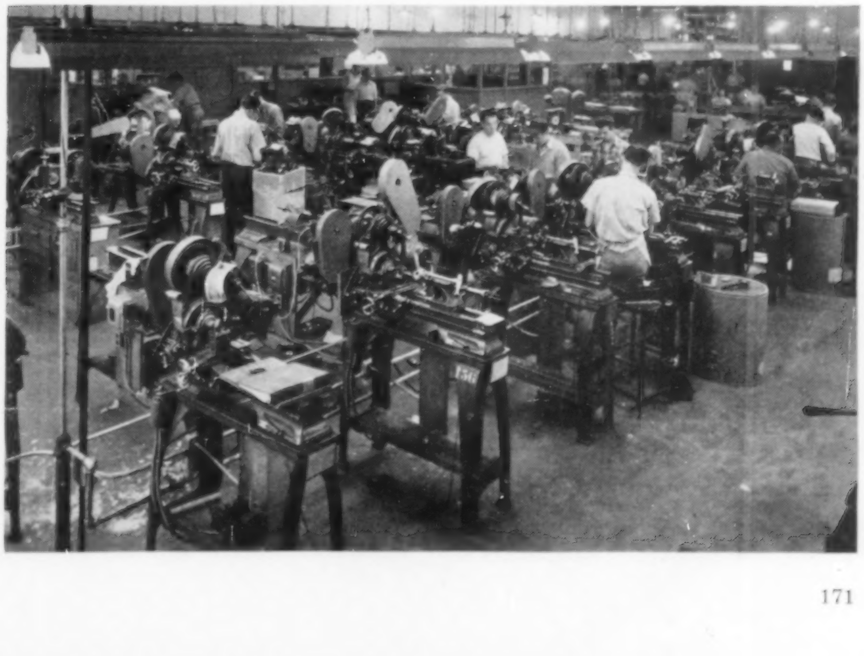
Among the proprietary articles are bridge and table lamps which combine strength and beauty with variegated color schemes. The first of these was designed by Galehouse after his wife had shopped for a lamp without finding one that pleased her. Another creation is a Book Reader that can be adjusted to incline the printed page at the desired angle for reading in bed. A recent addition is a repeater pencil that permits the user to choose a lead of any one of six colors by merely turning a clip. For the housewife, there are canisters in different attractive colors and with close-fitting covers. Another household product is a bucket that will store ice cubes without melting for 48 hours. There are handles for files and similar tools that are virtually indestructible. A new item is an egg-shaped receptacle that takes an entire fishing kit except the rod and reel. The angler empties it of its contents and then has a bobber.

In order to market these articles separately from the mouthpieces, the Ross-Frederick Corporation was formed last year. It will hold patent rights from and distribute noncompeting products of other manufacturers. The mouthpieces are sold direct to approximately 1500 music stores in this country and marketed abroad through exporters.

By way of clarifying the description of the Brilhart operations that follows we will set down a few elementary facts about plastics. To begin with, a plastic is a material that consists of or contains an organic substance of considerable molecular weight and that, although solid in the finished state, has been or can be formed at some stage in its manufacture into various shapes by flow, usually through the application singly or together of heat and pressure.

While plastics have attained big-industry stature only in the past decade or so, the first commercial material of this sort—celluloid—has been used since 1868, when an Albany, N. Y., printer, John W. Hyatt, produced it by mixing cellulose nitrate with camphor. His experiments were prompted by a shortage of ivory, and celluloid initially served as a substitute for that material in making billiard balls. The next significant development was the utilization, in 1895, of shellac, an insect-produced resin, in the manufacture of phonograph records. In 1909, while seeking something better than shellac, Dr. Leo H. Baekeland synthesized the material that has become known as Bakelite by reacting phenol (carbolic acid) with formaldehyde. In the same year, bitumen plastics were compounded from asbestos, asphalts, coal tar, stearin pitches, natural and synthetic resins, and oils. Casein, made from skim milk and formaldehyde, appeared in Europe in 1890 and in the United States in 1919.

Since 1925, twenty-odd additional plastic compositions have been developed or introduced, and their collective wide range of characteristics has made

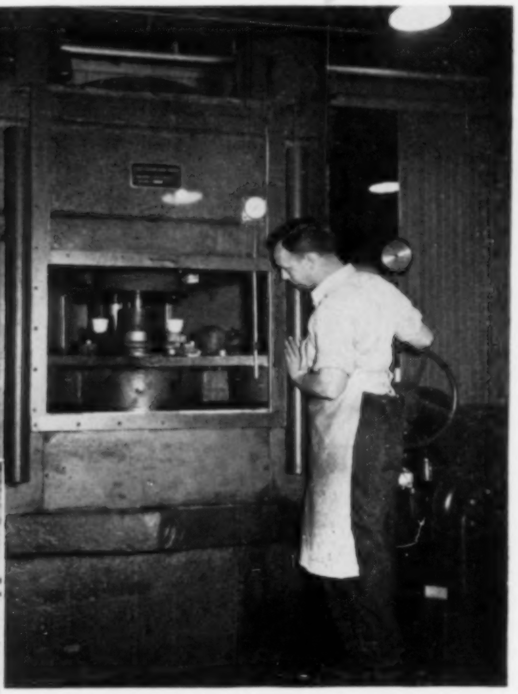


**GENERAL FINISHING DEPARTMENT**

At first glance, the department at the right might be a metal-working machine shop. Most of the units are small, high-speed lathes that have been adapted to turn out work on a mass-production basis. One of them is shown above at close range. It is equipped with Mead air clamps or cylinders that operate the tailstock, the collet chuck for holding the work, a blowgun for clearing away turnings, and change the direction of the lead screw. A divided foot treadle enables the attendant to control the machine and leave both hands free to handle the work, in this case pen barrels on which grooves are being machined.

**MACHINE SHOP**

Tool and die making is such an intimate phase of plastics manufacture that it is considered basic to its success. It is obviously of advantage to have this service under the same roof and management as the production department, which is the case here. Die making necessitates the use of various special machines, among which is the hobbing press shown at the right. Its ram exerts a pressure up to 1500 tons, sufficient to impress cavities in steel die blocks and thereby reduce machining operations. Here it is hobbing a die for making plastic tops for nursery-bottle containers that serve to keep the milk warm. A finished top is seen at either side of the cylindrical die block.



it possible to select materials that are exactly suited for certain of the manifold uses to which they are now put. It is significant to note that plastics are all resins and that the basic ingredients of most of them are derived from commonplace animal, vegetable, and mineral substances such as coal, petroleum, natural gas, salt, limestone, water, and air.

There are two broad classes of plastics: thermosetting and thermoplastic. The former set or harden when subjected to heat, becoming infusible and insoluble. Like a hard-boiled egg, they cannot be resoftened by reheating. Thermoplastic materials, however, are softened by heat and hardened by cooling. Upon being reheated, they become fluid again and can be reshaped. In this respect they are similar to metals.

United States plastics processors get their materials from about 25 domestic companies, most of which are large chemical manufacturing concerns. For molding or extrusion, the compounds come in powder, granular, or flake form, while fabricators receive them in sheets, rods, tubes, films, or special shapes which they machine into finished or semifinished products. Laminators impregnate paper, cloth, and wood, or treat glass fibers with liquid resins as a step in making composite sheets, rods, etc.

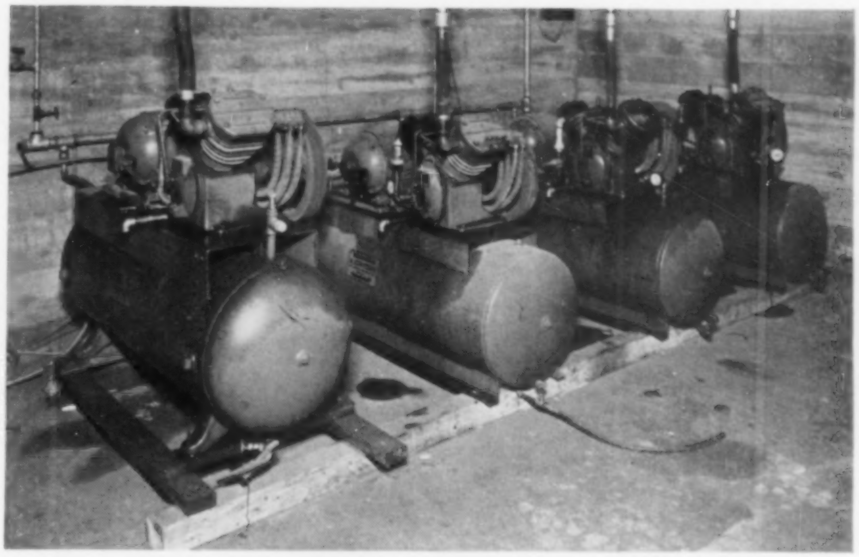
We are concerned chiefly with the molding of plastics. There are two basic methods of molding—compression and injection—both of which have many variations. Compression molding is used in forming thermosetting materials generally in vertical presses. A horizontal mold or die is filled with the plastic compound either powdered or in tablets (preforms), and a mating die descends under pressure. Both dies are heated. In what is known as transfer molding, a modification of the aforementioned process, the material is first heated to the fluid state in a transfer chamber and then forced by means of a plunger into a closed mold, where it undergoes forming and hardening. Where complicated parts with metal inserts are to be made, this method serves to flow the plastic around the inserts without disturbing them. Injection molding is used in the case of most thermoplastics. The material is fed from a hopper into a cylinder, from which a ram pushes it under high pressure into a heating chamber. The previous batch of material has meanwhile been melted, and the incoming batch forces it out of the heating chamber into an unheated mold, where it hardens.

The Brilhart plant does injection, compression, and transfer molding, with the former accounting for the greatest output. There are twelve standard injection-type presses ranging in production capacity from 4 to 12 ounces each. A 2-ounce machine, with which the firm launched its business and which served until recently to form reeds, has been retired. The presses are hydraulically operated and are fully automatic. Temperature, pressure, and time required vary with the molding material and the size and shape of the work, but once these factors have been determined and the controls properly set, the same cycle is repeated over and over with split-second accuracy. Products turned out thus far have called for temperatures from 270 to 600°F., most of them requiring from 400 to 450°. The over-all time of a cycle has ranged from twenty seconds to seven minutes. The plastics used have included just about every kind that can be injection molded. Materials for custom molding are commonly specified by the clients.

Small items—some so tiny that it takes 50 or more of them to weigh an ounce—are molded on five air-operated presses attended by girls. Lucite crystals for wrist watches, small camera lenses of the same plastic, and nylon parts for textile machines are typical of the articles made by these presses, which were designed and built by Brilhart engineers.

A separate department is devoted to compression and transfer molding. Most of its products are relatively small, and seventeen of the twenty machines available are bench-type models of miniature size, compared with those of the injection type. By far the greater percentage of the work turned out by the transfer presses are parts for electrical and electronic apparatus that contain fragile metal inserts.

Good dies are a prerequisite of high-quality molding. They must be not only precise in dimensions but also polished to a mirrorlike finish, for their surfaces alone impart a smooth, glossy finish to the articles formed in them. In order to control this vitally important phase of the manufacturing process, Brilhart, Ltd., has its own die-making section and toolroom. Dies are of special steel, and it goes without saying that skilled craftsmen and much mechanical equipment are necessary to produce them. Many of the dies are of the multicavity type, permitting up to twelve identical parts to be molded at the same time. Each die cavity must, of course, match all the others down to the minutest detail.



**SOURCE OF AIR SUPPLY**

The air compressors are a good index of the rapid growth of the firm. In the beginning, one Ingersoll-Rand air-cooled, 5-hp., Type 30 unit delivering 26 cfm. sufficed for all needs. As operations expanded, others were added until there are now six identical machines. The four shown here furnish air for the molding department and the machine shop. Two others serve the general finishing department. All are equipped with automatic controls that are set to start them when the receiver pressure drops to 120 psi., and to stop them when it has built up to 160 psi. The units pictured take their air supply from outside the building.

The machine shop is also equipped for the quick repair of presses and all other machinery, thereby reducing production delays to a minimum. Similarly, it facilitates changing machines, something that is frequently required because of the periodical demand for new products. Another important function of the department is that of making and reconditioning the cutting tools used in fabricating and finishing the molded articles.

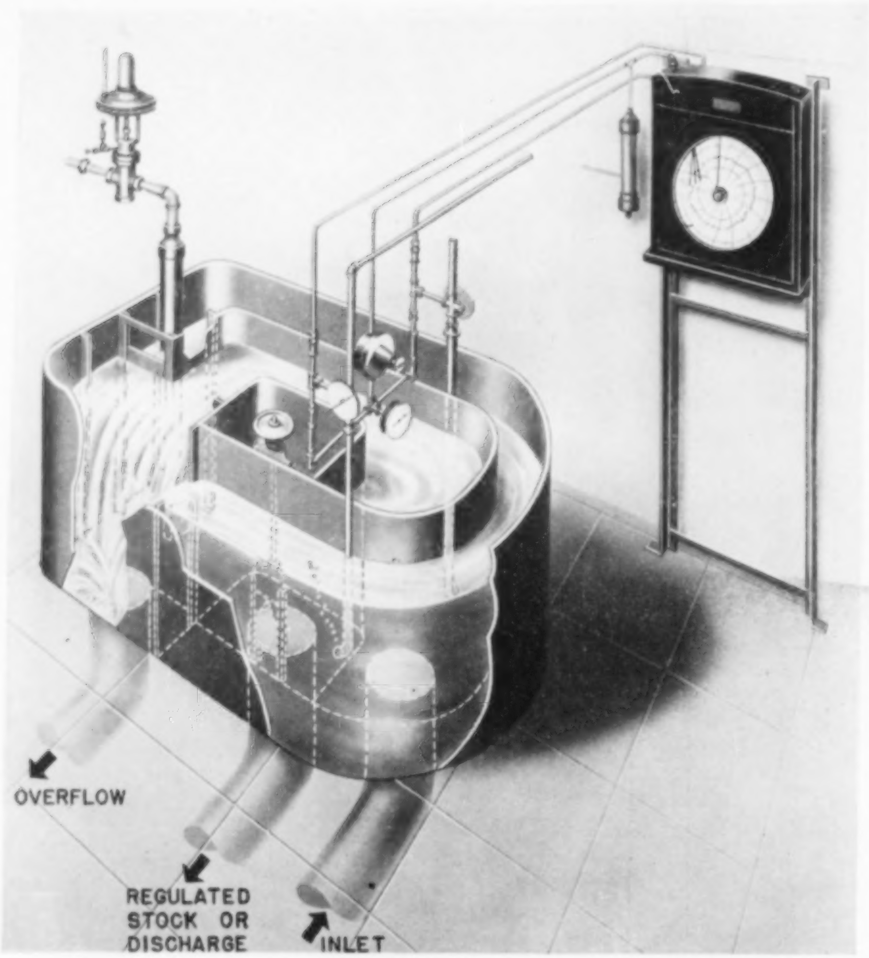
Some products come from the presses needing only minor attention such as the removal of flash or buffing to fit them for their intended purposes. Others require rather extensive machining and finishing. Mouthpieces, for example, must undergo three separate cutting operations and half a dozen other treatments before they are completed. They are handled in a special section equipped and staffed for the work.

All other items are finished in a central department where it is possible to perform virtually every operation that can be done in a modern metalworking machine shop, the outstanding difference being the machinery, which is smaller in the case of plastics manufacture. The working techniques, however, are dissimilar. Plastics must be machined to extremely close tolerances, and special arbors and holding fixtures are needed so as not to strain and distort the material. Much of the machining is done on small, fast-running lathes that are set up and tooled to perform specific functions. In some instances, operations per machine in an 8-hour shift total as many as 6000. In addition to being machined, some pieces require special finishing operations such as engraving, dyeing, painting, or lacquering, and facilities are available for doing all of these things.

**INSPECTION**

Here, under strong illumination, small products that go through the general finishing department are carefully examined for defects before being packed for shipment. Women excel in handling the smaller pieces. The girl in the foreground is inspecting camera lenses.

To hold pieces for turning, many of the lathes are provided with pneumatic chucks or collets that simplify loading and unloading and speed up production. Special attachments for standard machine tools have been designed by company engineers to fit them for certain jobs or to increase their output, and complete machines have been devised for specific purposes. A number of these, such as the one for stamping out individual camera lenses from a multimolded cluster, are air operated. All cutting machines are equipped with blowguns for clearing away chips, and there are cases where air is blown on cutting tools so that the heat of friction will not plasticize the thermoplastic materials on which they are working. Compressed air is also used in sandblasting some products during the finishing stages.



**BRAMMER AND CONTROL INSTRUMENTS**

The cutaway view (left) shows the Brammer with its piping and instrument controller. The regulating box is streamlined to prevent the stock from stagnating in its flow and is ordinarily made of stainless steel. It can be built of wood, if desired.

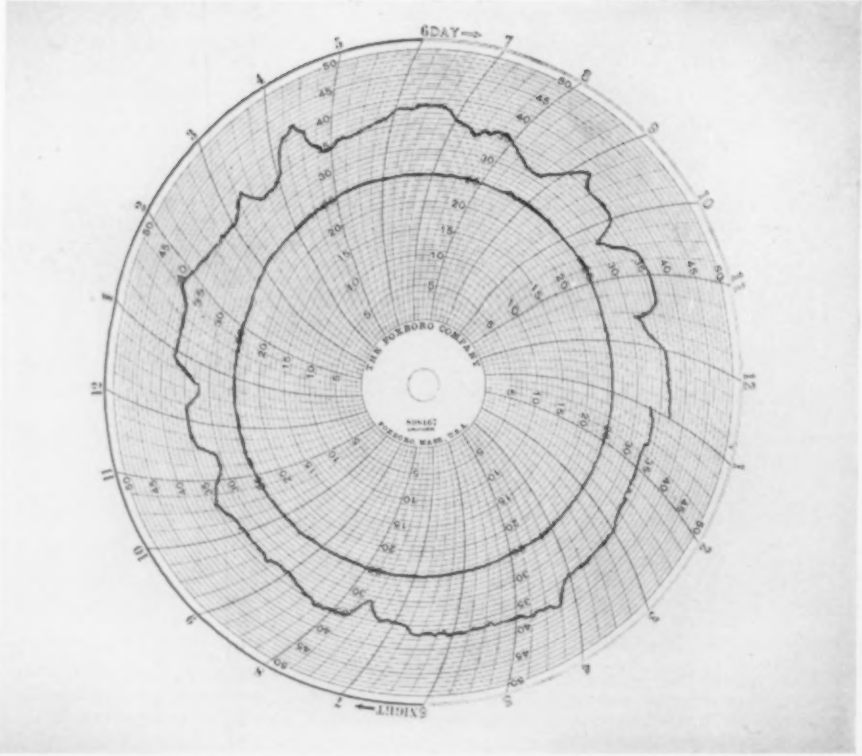
# Keeping Paper Stock Consistent

IN MANUFACTURING paper, it is essential to maintain the stock at a definite consistency in order to obtain the desired results. Consistency can be defined as the proportion of paper-making fibers to water. Thus a stock of 1 percent consistency is 1 part fibers and 99 parts water. Consistency is important at various stages in the mill process, and variations from the optimum values will cause trouble whenever and wherever they occur.

Consistency was formerly controlled solely by mill attendants, who turned valves to admit more or less water when they found this to be necessary. Manual control is not satisfactory, however, because an operator cannot judge consistency with enough precision to regulate this factor. Frequent testing also is impractical because tests cannot be performed with sufficient speed and accuracy to permit making adjustments in time to eliminate variations in consistency.

It is consequently understandable why paper-making technicians have applied themselves to devising mechanical apparatus for closely controlling consistency. A recent development along this line is the Brammer, which is completely air operated. The machine bears the name of its inventor, who conceived and developed it while in the employ of the Thames Board Mill in England. It is manufactured by Paper & Industrial Appliances, Inc., 122 East 42nd Street, New York, and utilizes instruments made by the Foxboro Company of Foxboro, Mass. It is claimed to be capable of maintaining consistency within one-tenth of one percent.

Consistency bears a definite relationship to viscosity. Consequently, if viscosity is kept uniform, consistency will vary only negligibly. The relationship cannot be expressed by a straight line but rather by a curve that is flat at the lower consistencies and steep at the higher ones. For this reason a consistency regulator will be least sensitive



**DAY'S RECORD**

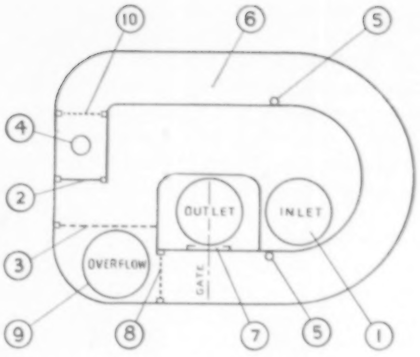
The chart at the right is an actual record of the performance of a Brammer for a 24-hour period. The inner line indicates the consistency of the stock leaving the head box, and its uniformity is apparent. The outer line shows the air pressure supplied to the motor that controls the water-dilution valve and is a record of the consistency of the stock entering the Brammer.

at the lower consistencies, and it is therefore desirable to regulate at the highest possible consistency.

If stock is allowed to flow in a trough it will assume a natural surface slope, and the more viscous the material, the steeper the slope. By measuring the drop between two points, the consistency can be determined. By means of a suitable instrumental hook-up, the measuring impulses can be amplified and made to operate a valve to admit more or less water, as may be needed, to maintain the consistency within the desired limits. The sensitivity of this method may be adjusted by varying the distance between the two measuring points. As the distance is increased, smaller variations in consistency are required to produce a high level difference along the slope.

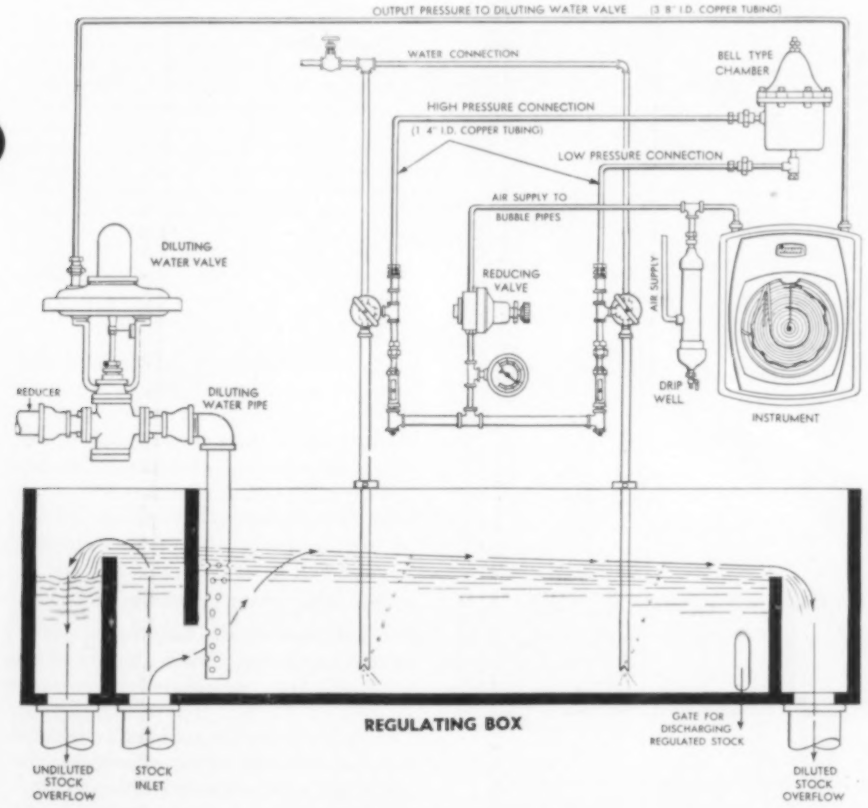
In the Brammer, the measuring medium is compressed air, which bubbles out of the open ends of two pipes that are immersed in the stock at the measuring points, as shown in the accompanying schematic drawing. After being filtered, the air supply for these pipes is passed first through a valve that reduces its pressure to 17 psi., and then through two Foxboro sight feed-check flow units. Nonclogging-tubing resistance elements in these units accurately limit the volume of air admitted to each pipe. Since the depth of the stock varies at the two points, as already explained, it is apparent that the resistance to the emission of bubbles will vary accordingly. In other words, there will be a differential in pressure, which is, in reality, a measure of the drop in stock level between the two points.

In operation, the level of the stock rises as its viscosity increases, and the air pressure builds up in each pipe until it equals the head of the stock in which it is immersed. When it is greater than the head of the stock at either point, air will be emitted and rise through the stock as bubbles. The quantity and size of the bubbles, however, is such as not to disturb the measuring system. Conversely, as the stock level falls with a decrease in viscosity, excess in air pressure over the stock head causes bubbles to issue at an increased rate until the system acts to restore equilibrium.



### PLAN VIEW

Entering at 1, the stock flows under a dam, 2, into trough 6. Excess stock passes over an adjustable dam, 3, into an overflow pipe, 9, which returns it to the feed circuit. This serves to maintain a constant supply in trough 6. Dilution water is added through a perforated pipe, 4, and thorough mixing is insured by the aid of an adjustable baffle, 10. The stock moves around the trough, and a dam, 8, at the end of its travel keeps a constant head on the outlet gate 7. By adjusting the height of dams 3 and 8, constant flow conditions of the stock are maintained in the trough. Two bubble pipes, 5, measure the stock slope by means of the differential in air pressure encountered at the two locations. The interval between these pipes may be changed to meet the conditions imposed by stocks of different viscosities. Special boxes that provide extra-long flow channels are utilized wherever it is desired to regulate stocks of very low consistencies—that is, stocks having a high percentage of water to fiber. This permits attaining adequate level differences for regulator operation.



### SCHEMATIC DIAGRAM

Here is illustrated the operating principle of the Brammer control. The slope the stock assumes in flowing varies with its viscosity, which bears a definite relationship to its consistency. The viscosity is determined by measuring the difference in surface level or drop between two points, the measuring media being two bubble pipes. The differential in air pressure required to overcome the head of the stock at the two locations acts on a diaphragm in the bell-type chamber, and the movements of the diaphragm are transmitted by air line to a valve that regulates the admission of dilution water to the stock to maintain it at the desired consistency. Although shown separately for clarity, the bell chamber is actually an integral part of the Foxboro Stabilog control instrument.

The two bubble pipes are connected to a sensitive mercury-sealed bell such as is used in precision gas measuring. They deliver their pressures to opposite sides of a diaphragm within the bell. Movement of the diaphragm, which is directly proportional to the differential pressure and hence to the stock slope or stock consistency, is recorded on a chart. Also connected to the pressure and measuring system is a Foxboro Stabilog control mechanism that serves to amplify the consistency changes and to transmit them immediately to an air-operated diaphragm-type water valve that regulates the admission of dilution water to the stock as required to maintain the desired consistency.

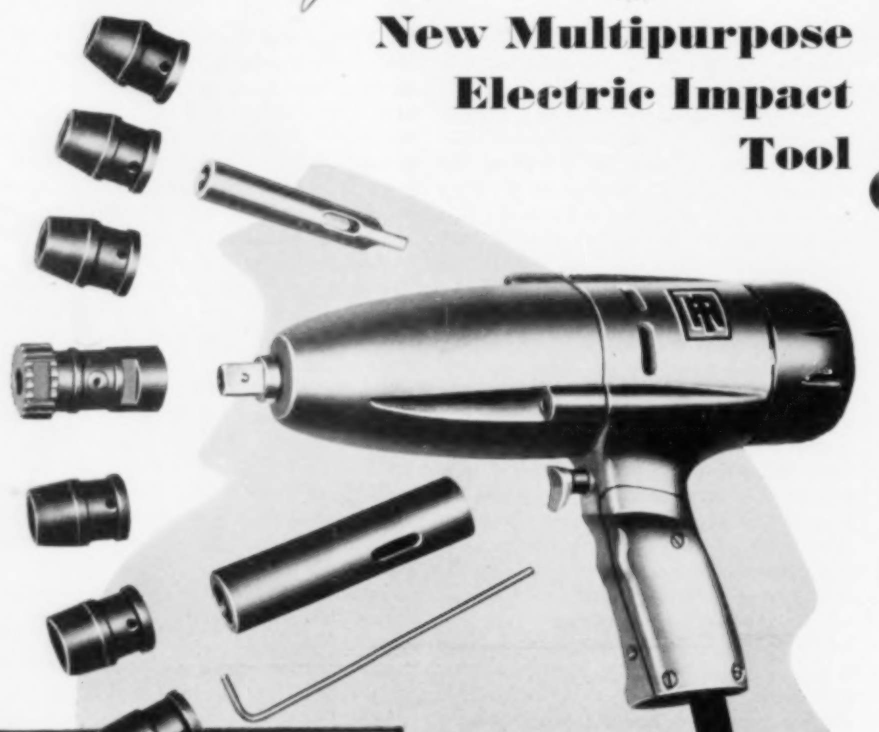
The Brammer has been applied to regulating the consistency of a wide variety of stocks, ranging from those for extremely light cigarette paper to heavy roofing felts. It is claimed that it operates satisfactorily even with such difficult stocks as "lumpy" or stringy rags, dirty waste paper, or free sulphite. Although it is most commonly used just ahead of paper-making machines to insure uniform weight and thickness of the finished products, it is also employed at other points in the preliminary processing of the fiber. In any case, the system can be set to deliver any desired consistency merely by turning a knob.

# New Multipurpose Electric Impact Tool

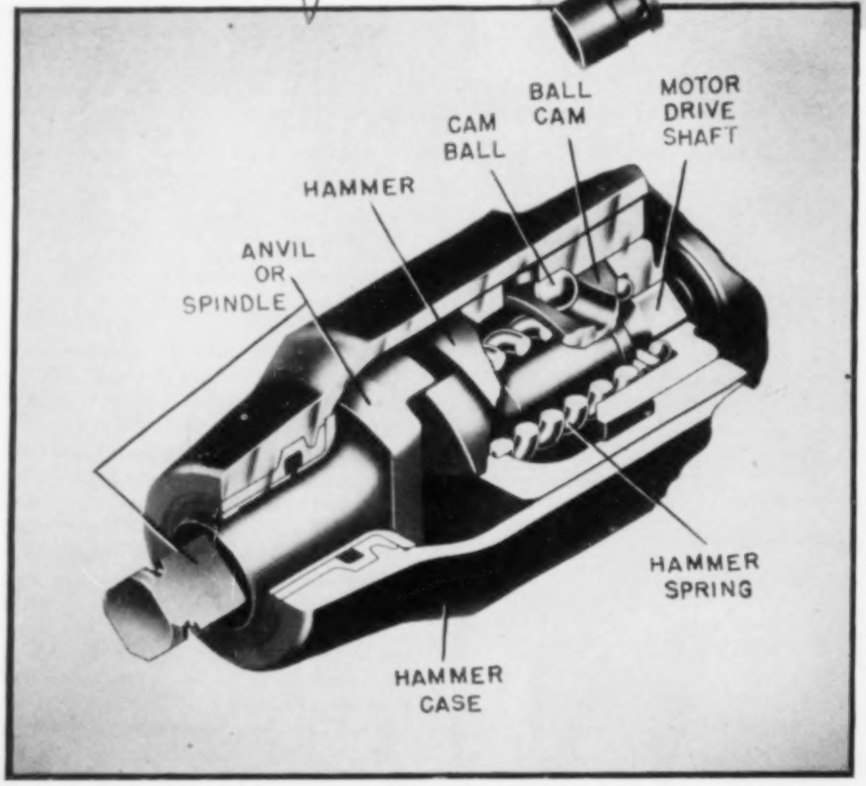
A NEW tool—an electric impact tool—that is noteworthy for the diversity of work it will do, its light weight, and ease of handling has been introduced by Ingersoll-Rand Company. Its range of performance encompasses operations that ordinarily require the use of four separate tools the aggregate cost of which is three times its selling price.

Using standard attachments, the tool will apply and remove nuts; drive and remove studs and screws; extract broken cap screws and studs; drill, ream, and tap in metal; drill brick and masonry; drive wood augers; and do wire brushing and hole-saw work. It is powered by a 110-volt, 3-ampere universal motor that operates on direct current or 25-, 40-, 50-, or 60-cycle alternating current. It can be reversed by merely turning a cap at its rear end 60°.

When it starts to function, the impact tool runs like any conventional electric tool, with the spindle turning at 1900-2000 rpm. After a certain resistance to spindle rotation has been built up, a patented mechanism converts the power of the motor into rotary impacts that exert a more powerful turning effect than is produced by any other electric tool of comparable size.



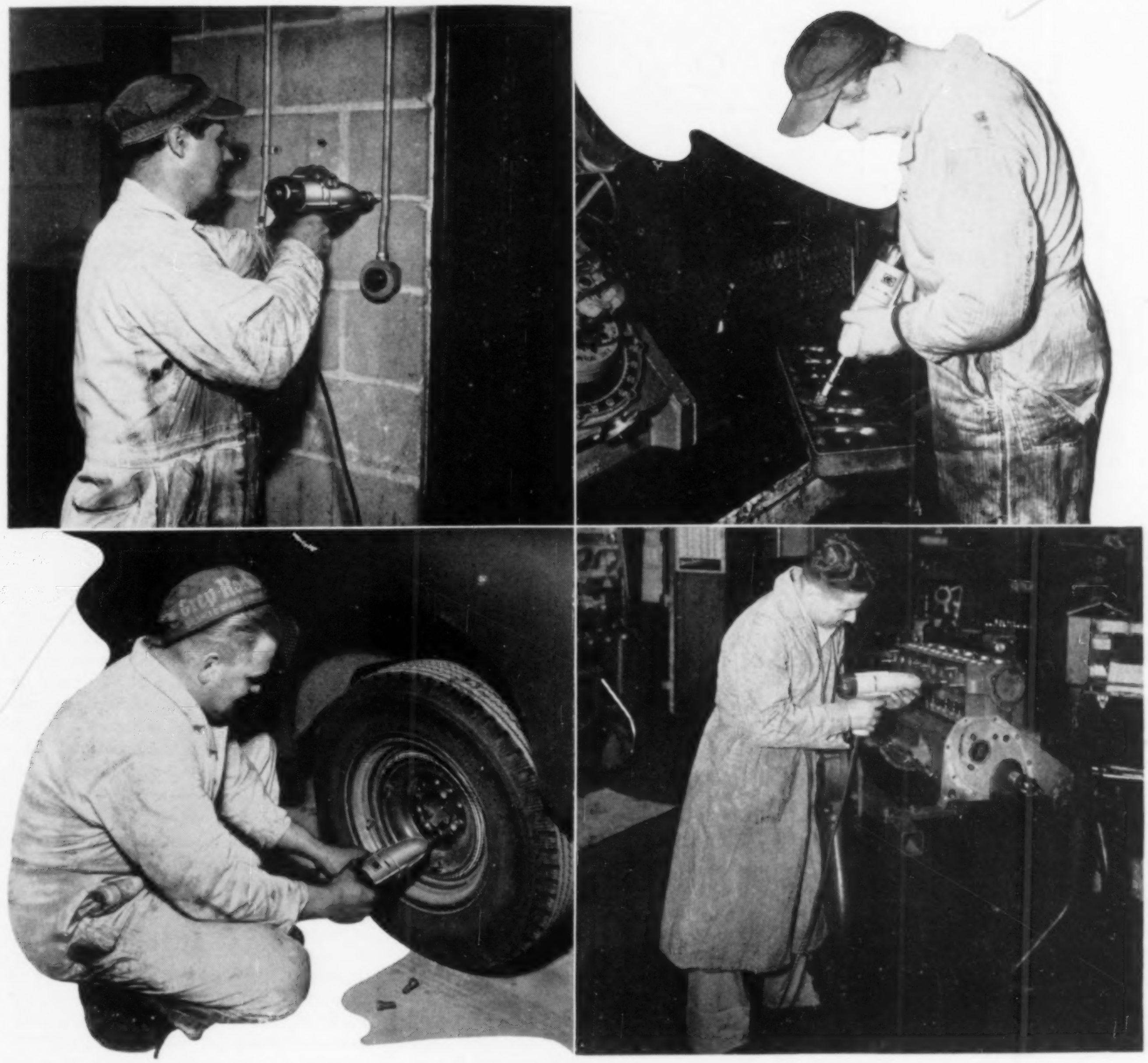
**TOOL AND EQUIPMENT**
Of streamlined contour and having an offset handle designed for firm and comfortable holding, the tool is constructed of the lightest materials that meet the strength requirements. Standard equipment consists of a collet-type chuck to handle all round-shank attachments from $^3/_{16}$- to $^3/_8$-inch diameter, including square-end taps and reamers, six hexagon sockets ranging in size from $^7/_{16}$ to $^3/_4$ inch, a No. 2 Morse taper socket, a No. 1 to No. 2 Morse taper sleeve, and an Allen wrench.



**DRIVING MECHANISM**
When the jaws of the hammer and the anvil are in contact, as shown here, the ball cam, hammer, and anvil or spindle rotate as a unit and the tool runs like any conventional electric drill. When the resistance of the work to the anvil exceeds the initial pressure exerted by the hammer spring, the anvil becomes stationary. The motor, however, continues to run, and through rotation of the ball cam causes the cam balls to roll in their grooves, pulling the hammer back over the ball cam and compressing the hammer spring. As the hammer is drawn back, its jaws disengage the anvil jaws and slip over the top of them. The power stored in the compressed hammer spring then pushes the hammer forward toward its original position. By the time the cam balls reach the lower part of their track the hammer has attained maximum velocity and delivers a powerful rotary impact on the anvil. There are two hammer jaws, 180° apart, on the spindle, and two blows are therefore struck with each revolution of the spindle. Under full load the tool delivers 1900 impacts a minute.

The new tool delivers 1900 rotary impacts per minute through the medium of an accumulator-hammer-and-anvil mechanism. If the spindle stalls for any reason, the motor continues to run unharmed, thus eliminating the possibility of burning it out. This is a major advantage of the impact-design principle in view of the fact that the most prevalent cause of electric-tool failure is burnt-out motors. Its effect should be continuity of service and low upkeep cost.

Thus far one size, designated as the 4U, has been produced. It weighs only 6½ pounds and is but 10½ inches long. As the housing is only 3 inches in diameter, the tool can be readily fitted into confined spaces or used close to side walls. Because of the nature of the impact mechanism, the operator feels no torque reaction, or twisting tendency. This feature greatly reduces operator



TYPICAL APPLICATIONS

Using a carbide-tipped drill, it takes only a few seconds to drill a hole in a wall for a strap holder for an electrical conduit (upper-left). The impact tool should be a boon to garage workers by speeding up such operations as removing wheel-holding bolts (lower-left). Fitted with a wire brush, the new tool is shown at the upper-right making a quick job of removing carbon accumulations. When a broken stud has to be removed a hole is drilled into it for the insertion of a screw extractor with which the stud remnant is run out. This is illustrated at the lower-right.

fatigue and also makes it possible to hold the machine with one hand and thereby reach into inaccessible spaces when necessary.

The expectations are that many industries will find the tool a time-and-labor saver in production work, while virtually all kinds of plants will be able to use it advantageously in maintenance work. It will be sold in the United States through distributors.

The capacity of the Size 4U in performing the principal operations for which it is designed has been rated conservatively. It will do the following:

Apply and remove nuts and cap screws, drive and remove studs, and extract broken cap screws up to ⅜-inch thread size.

Drill ¼-inch holes in metal and enlarge them to ½ inch by step drilling.

Ream holes up to ½-inch diameter.

Tap holes from ¼ to ½ inch.

Drive and remove all types of machine screws up to ⅜-inch thread size and wood screws up to Size 20.

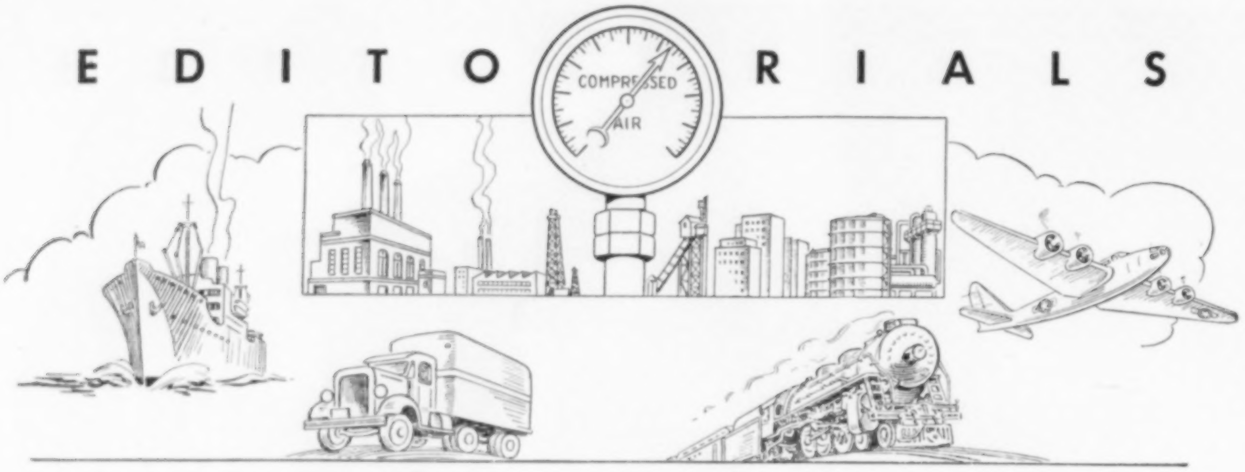
Run wire brushes with round shanks up to ⅜-inch diameter.

Operate wood-boring twist drills up to ⅜-inch with a collet-type chuck and up to 29/32 inch with a Morse taper.

Drill holes in brick and masonry up to ⅜ inch with carbide-tipped drills.

The Electric Impact Tool is an outgrowth of the air-operated impact wrench that was introduced by Ingersoll-Rand Company in 1933 and that has been widely adopted for speeding up bolting and similar work. As a matter of fact, it was the original intention of the inventor, R. H. Pott, to operate the tool with a universal electric motor. Because a suitable motor was not available at the time, and the air motor had the required characteristics, the wrench was made a pneumatic tool. Subsequent research and changes in design have now made it possible to apply electric drive and thus greatly extend the advantages inherent in the impact principle of operation.

# EDITORIALS



## WATER THROUGH MOUNTAINS

STORM clouds borne by prevailing westerly winds strike the Rocky Mountains and deposit most of their moisture before passing over the range. This is especially true in Colorado, where the Continental Divide attains its greatest height. As a result, the western slope has a comparative abundance of water while the eastern slope is normally thirsty. Inasmuch as most of the arable land lies east of the mountains, the problem that has confronted farmers is apparent.

Since colonization of the region began in 1859 irrigation has been practiced on a mounting scale. At first, sufficient water could be obtained by diverting it from the snow-fed streams during the growing season. As more acreage was placed under cultivation, it became necessary to construct reservoirs to catch and store the spring run-off for later distribution. Some years ago the point was reached where even this careful husbanding of the meager precipitation failed to meet the needs. In one 6-county area, embracing 615,000 acres of tenanted farms, there has long been a shortage of water in the late growing season. In consequence, full crops have not often been harvested, and the resultant monetary loss has ranged as high as $12,000,000 in a single year. This area, centering around Greeley, has a population of 177,000 persons and is one of the nation's leading sources of sugar beets.

For decades past, eastern-slope agriculturists have cast covetous glances across the mountains and tried to figure out how they could economically procure some of the surplus water that flows off the other side. In 1889, Hiram Prince, a member of the Colorado Legislature, sponsored a bill appropriating $25,000 to investigate the matter. The money was spent on surveys by which it was determined that a diversion tunnel at least 3 miles long would be needed. The estimated cost of such a bore, plus the other works that would have been involved, was so great that the scheme could not then be considered seriously.

Twenty years later, Fred Fair, a Colorado mining engineer with vision, conceived the idea of piercing the divide with a 9-mile-long tunnel. He proposed to construct a balancing reservoir near the eastern portal and then drop the water through pressure conduits a vertical distance of 1800 feet to generate power. After passing through the turbines, the water was to be sold for irrigation of the plains to the east. The Boston-Colorado Power Company was organized and did considerable preliminary work, although the driving of the tunnel was never attempted. The concern ran out of money, and Fair knocked on many doors in the financial district of New York without convincing anybody that his scheme would pay off.

Meanwhile, the Bureau of Reclamation had begun a general investigation of the feasibility of diverting western slope water, and these studies were continued from time to time. In 1935 that Federal agency was allotted $150,000 from National Industrial Recovery Act appropriations to make surveys and prepare plans and cost estimates. Out of these efforts grew the Colorado-Big Thompson Project, on which construction began in 1938. Thus far $37,500,000 worth of work has been completed, and $42,638,000 more is now under contract. The key structure is the 13.1-mile Alva B. Adams Tunnel through the divide, which was started in 1940 and holed through in June, 1944, after several interruptions caused by the war.

Permanent structures to lead the water from the east portal of the tunnel down to the Big Thompson River are now being built. Meanwhile, the farmers in the Greeley area, who need this water badly, have financed the laying of a temporary wooden-stave pipe line to span that gap. It was placed in service on June 23 and will make it possible to augment the 1947 water supply by 90,000 acre-feet. Eventually, the permanent works will convey an average of 310,000 acre-feet annually. Seven hydroelectric plants will take advantage of the 2900-foot drop on the eastern slope to generate power.

Water purchases by farmers and sales of electricity will repay the construction cost of $128,000,000 within a period of 40 years. During that time, it is estimated, benefits totaling a billion dollars will be derived from the development. It is expected that $846,000,000 will be added to the incomes of farmers and processors of crops and livestock. Power revenues have been calculated at $151,000,000 and those from recreational features at $12,720,000.

The Alva B. Adams Tunnel is the longest irrigation bore ever driven. To break the 310,000 cubic yards of rock excavated, 480 miles of blast holes were drilled and 1240 tons of dynamite was exploded. The 9-foot concrete tunnel will carry 550 cubic feet of water a second. Diversion began last week and marked the first time that water has been transported through the Continental Divide for irrigation purposes.

Federal and state officials and interested citizens inaugurated the diversion with an all-day celebration. At the western portal of the tunnel, Gov. Lee Knous of Colorado turned a valve that admitted water from Grand Lake into the bore at 11 a.m. He and other members of the party then drove 50 miles over snow-covered mountains to the eastern end, reaching there in time to witness the arrival of the first water shortly after 2 p.m. The ceremonies there included an address by Oscar L. Chapman, Under Secretary of the Department of the Interior, of which the Bureau of Reclamation is a part. While waiting for the water to come through the bore, the group at the east portal attended a luncheon at which the guest of honor was Mrs. Alva B. Adams, widow of the late senator from Colorado for whom the tunnel was named in recognition of the services he rendered in bringing the transmontane diversion plans to fruition.

# This and That

**7000-Mile Trip by Tugboat**

A 64-foot tugboat recently traveled under its own power from Trenton, Canada, to Rio de Janeiro, Brazil, covering the 8000 miles in 43 days. Its 240-hp. diesel engine drove it at a speed of from 10 to 12 miles an hour. The tug was sold as Canadian war surplus to the Brazilian Ministry of War.

* * *

**Concrete Freight Cars**

The Germans have found ways of employing concrete that are unknown in this country, according to an investigation conducted for the Office of Technical Services, Department of Commerce. In Heidelberg a company casts freight cars from prestressed reinforced concrete, complete except for wheels, springs, and drawbars. It is said to have orders for 1000 units. In Munich, the street railways have been using concrete brake shoes for several years to save cast iron, which was being worn away at the rate of 4 tons daily. The concrete shoes are reported to last approximately three months.

* * *

**Street Lighting Shortage**

Although automobile traffic is three times heavier in daylight hours than after dark, two-thirds of all accidental fatalities occur at night. One of the corrective measures that has long been urged is better street and highway lighting. It is estimated that 50,000 miles of urban streets have inadequate illumination, or none at all. Authorities state that expenditures for all municipal services have increased from 200 to 300 percent since 1911, but that there has been no increase in street-lighting appropriations, which now amount to but two cents of every dollar spent and average only $1 per capita in the nation. The aim is to raise it to $2 per person. New Jersey is seeking to solve the problem through state aid. It pays the cost of placing a 2500-lumen lamp each 200 feet of state-designated highway within the corporate limits of municipalities that request such aid. It also finances considerable highway and intersection lighting outside of urban limits. In addition to reducing accidents and facilitating traffic, good lighting lessens crime, aids police and firemen, improves business, increases property values, and enhances civic prestige.

MANHATTAN
GLUECK

"She wants we should keep our eyes open for Indian arrowheads or fossils for her Junior's collection."

* * *

**Cerium Lighter Flints**

Cerium, the commonest metallic element among the group of so-called rare earths, has been extensively employed in Germany for making cigarette-lighter flints. Cerium looks like iron but is as soft as lead. When alloyed with iron to form *Mischmetall* it gives off sparks when filed or scratched. To form the molten metal into flints, it is either cast directly in tubes, forced into split molds with compressed air, or drawn into them by vacuum.

* * *

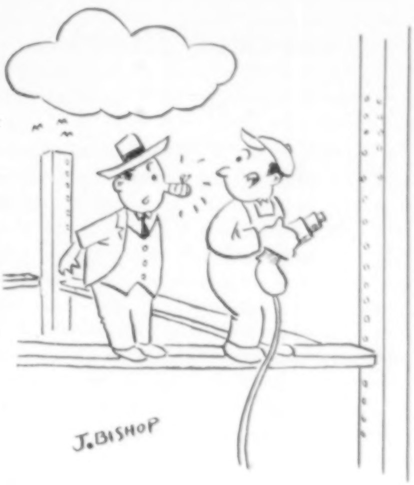
**Ghost Camp for Sale**

Rhyolite, Nev., once a thriving gold-mining camp, is up for sale. N. C. Westmoreland, who has owned the decadent town for several years, wants to dispose of it because he is in poor health. At its height, in 1906, Rhyolite had two banks, a newspaper, and a $50,000 school house. Most celebrated among its ruins is a building having walls of beer bottles laid in mortar with the bottoms forming the outer surface. The tracks of the Tonopah & Tidewater Railroad that once served the camp were torn up long ago, but the ornate stucco depot remains. It houses a night club that is patronized chiefly by visitors to nearby Death Valley. The 1930 census gave Rhyolite a population of twelve; the 1940 count listed twenty residents.

* * *

**New Chemical Seal Aids In Oil Recovery**

A new chemical, Dresinol, is reported to increase the output and to reduce the cost of recovering petroleum by the water-flooding method. Water pumped down an intake well to force oil through the sands to an output well naturally follows the paths of least resistance. Much of it goes into and through the looser strata, or "thief" sands, that have already been drained of oil. Consequently, it has been necessary greatly to increase the amount of water to insure penetration of the tightly packed sands containing the oil residues. Dresinol, which is produced by Hercules Powder Company, is poured down a well in advance of the water and plugs the more permeable layers, thus enabling the water to do its work more effectively. In one of several tests conducted in the Bradford, Pa., oil field, the use of Dresinol reduced the water consumption from 570 to 95 barrels a day. Water flooding in this one field has yielded 235,000,000 barrels of oil, and it is estimated that 700,000,000 more remain in the ground. In some instances, however, recovery has been uneconomical because of the large quantity of water required per barrel of oil produced, for all of it has to be pumped into the ground under high pressure.



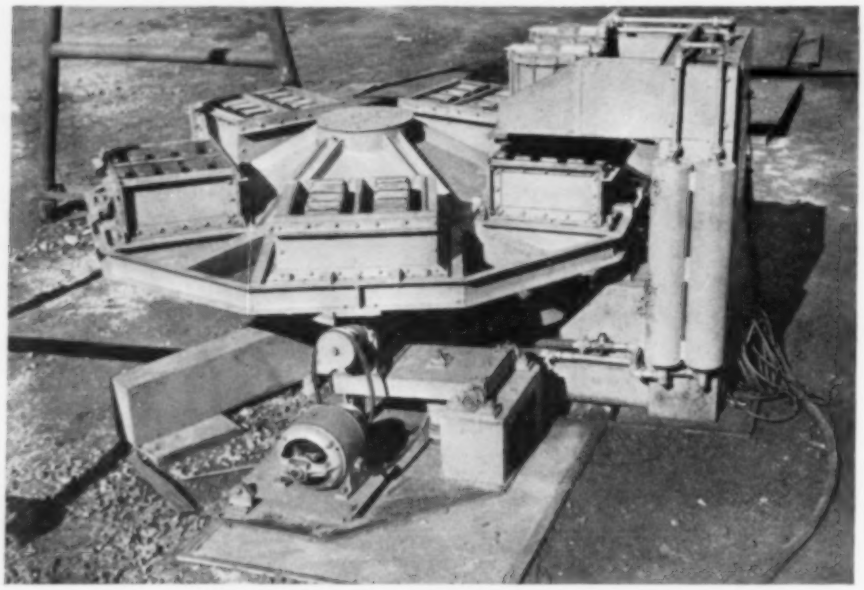
"How many times must I warn ya about lookin' over my shoulder."

* * *

**Btu's All Work Here**

The Cochrane Company, Philadelphia, Pa., reports on a rubber-goods manufacturing plant that makes the fullest possible application of heat generated in connection with the continuous operation of 32 vulcanizing presses. Steam used in the presses at 120 to 125 psi. was formerly flashed in an open well and partially wasted. Now a condensate return system evacuates the presses at 85 psi. and returns the steam directly to the boiler at a temperture of 325°F. Exhaust steam at 5 psi. from an engine driving an air compressor serves to heat boiler make-up water.

# Mass Production of Concrete Blocks



MAKES CONCRETE BLOCKS AUTOMATICALLY

The machine without the hopper mechanism, showing five molds in position on the rotating table. The molds are mounted on rubber. The housing on the right contains the electronic timer, switches, controls, air gauge, and filter, and in front of it are the two oil tanks that are a part of the pneumatic-hydraulic system by which the table is indexed from station to station. There is a similar set-up on the other side of the machine for transferring the finished blocks to a conveyor. Above the right-hand mold is the 2-cylinder pneumatic press by which blocks of standard size and density are formed. In the foreground is the motor that drives the vibrator.

MORE than 20,000 concrete blocks in three 8-hour shifts is said to be the output of a new machine designed and built by Henry & Hutchinson, Inc. The blocks are 8x16x8 inches in size and are produced automatically in a 4-stage cycle on a turntable mounting five molds fed by a hopper, which is a separate part of the equipment. The table is built of steel throughout and has a minimum of working parts, all operations being performed by pneumatic-hydraulic and air cylinders.

Rotation of the table is intermittent and is effected by a pneumatic-hydraulic cylinder that is actuated through the medium of two vertical tanks containing oil. Compressed air piped into the tops of these accumulators exerts pressure on the oil, thus causing the cylinder piston to pull the table to one of a series of indexed stations, where it is held by a pin shot in place by a pneumatic cylinder and where it remains for a predetermined period. The length of the stop depends upon the kind of block that is being made and is controlled by an electronic timer. Release of the air from the tanks retracts the pneumatic-hydraulic piston for the next stroke.

Starting at Station 1, each mold is spotted precisely beneath the hopper, which is opened and closed by an air cylinder and fills the mold with a measured amount of concrete. At this point another air cylinder raises an eccentric-weight vibrator to compact the material in the mold. The second move positions the latter under the block-forming press, which consists of two pneumatic cylinders capable of exerting a pressure varying from a few pounds to about 6 tons. Ejection of the finished product follows at Station 3. This operation, like the indexing of the table, is done by a pneumatic-hydraulic cylinder to assure smooth, steady movement. Upon removal, the product may be transferred manually or mechanically to a conveyor for transportation to a curing room or storage racks. The final stages involve replacing the pallet on the table and inspection of the mold for possible obstructions.

Air for the operation of the various cylinders is supplied at a pressure of approximately 150 psi. and is passed through a filter at the intake to remove moisture and foreign matter. The consistency of the concrete of which the blocks are made differs from that generally used in that the aggregates are coarse instead of granular. This is claimed to be a determining factor in the speed of output and, in combination with the pressure exerted to form the blocks, provides a light, compact, and strong product with uniformly straight sides and sharp corners. The company is now engaged in designing a machine with a capacity of nearly 29,000 blocks in 24 hours.

PLASTIC PACKAGING

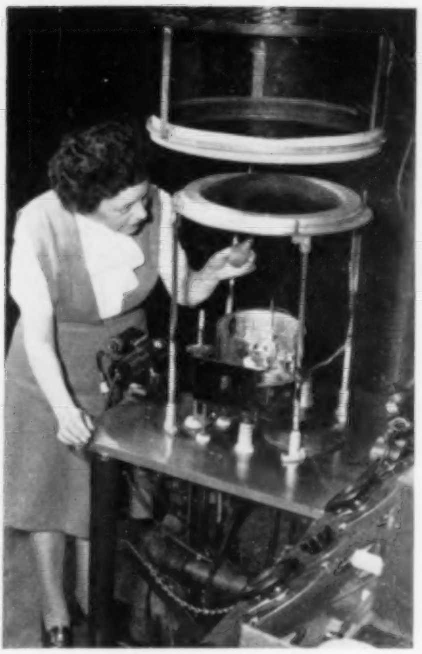
Spraying a metal stool with "Seal-Pul," a plastic material that will protect it from corrosion, rust, and scratches during shipment and storage. The coating can be removed by peeling, which is as easy as pulling the skin from a banana.

## Lumber Spray-Painted Before Storage

KILN-DRIED lumber arriving at the Montreal, Que., Angus Shops of the Canadian Pacific Railway for the construction and repair of freight and passenger cars receives a priming coat before storage principally to prevent it from absorbing moisture and also to serve as a base for the finishing operations. The equipment used for the purpose was designed there, and is built for volume production It, consists of a metal cabinet and of a battery of spray nozzles that are positioned to paint both sides and edges of a board in a single passage through the machine.

One man feeds the lumber, and another loads the coated material directly on to a truck for removal. At the receiving end there is a roller that is rotated by an air motor and carries each board into the cabinet, where three more rollers, with the aid of the succeeding board, move it through and out at the discharge end. The paint, which is in the bottom of the unit, is delivered to each nozzle by suction induced by passing compressed air over the end of the pipe extending from the nozzle to the tank. A hinged cover gives access to the cabinet for replenishing the paint, making repairs, and adjusting the nozzles, any one or number of which may be made inoperative by cutting off the air supply.

## Cleaning Glass by Bombardment with Electrons



**VACUUM CHAMBER**

Before the bell is lowered, operator blows dust from the first surface of a television mirror. Chamber is then evacuated and thorough cleaning and drying effected by bombarding the ground, polished glass with electrons. Still in the holder and under a high vacuum, the exposed surface is coated with aluminum by vaporizing the metal contained in a small crucible that is heated electrically.

ELECTRONIC bombardment is a new method of cleaning optical glass that is to be coated with aluminum and has solved a troublesome problem in the manufacture of television and other precision mirrors. Ordinary looking glass is coated on the back, but high-precision mirrors are coated on the front or first side in order to eliminate the otherwise almost imperceptible dual reflection of the image. The metal film is applied by the evaporative process in a vacuum bell or chamber.

Before the ground and polished glass can be coated, however, it must be free from dust and the unnoticeable residue of moisture that is always present on any surface. Drying can be effected only by heat, but aluminum will not adhere to a heated surface. Here was a puzzler, the answer to which was found in electronic bombardment by members of the Process Development Division of the Bausch & Lomb Optical Company. This work is done in the same vacuum chamber in which aluminum coating takes place.

The glass is placed in a metal holder mounted above a tungsten filament like that in an ordinary incandescent-light bulb. After preliminary dusting, the bell is lowered and the filament is electrically heated to a temperature at which electrons are "boiled out." Electrons, being negative particles, are attracted by the holder, which is at high-plus voltage with respect to the filament. They bombard the glass at a speed of several thousand miles a second and leave the exposed surface entirely free of extraneous matter and moisture. Unlike other methods, electronic bombardment heats only the surface, which cools well-nigh instantaneously to a temperature the same as that of the remainder of the optical glass. The aluminum film applied after this treatment will adhere. The evaporative method of coating has been described in our August, 1945, issue.

## Stone Fence Costs Forty Years of Labor

IN MANY eastern sections of the country, rocks taken from the land were formerly used to build fences. Some of the "slave" fences of the South were arranged with precision and followed a pattern that makes them very attractive. Having no slaves, the northern pioneers did their own work. Wire was not available to them and, anyhow, they had to do something with the boulders they removed to make their fields arable. The labor and time that were expended in these efforts would, by present standards, be considered prohibitive.

Our picture shows part of a fence on the farm of Ernest C. Garris, near Oxford, N. J. His grandfather, Jonas Snyder, bought the land when he arrived here from Germany about 80 years ago. Cleared ground was very high in price in that post Civil War inflation period, so he bought a 12-acre, uncleared tract for $480 and went to work.

All told, he spent 40 years on the clearing job, and the rocks he removed made 2½ miles of fences that were originally 6 feet thick and 6 feet high. Even then, he didn't consider his task finished. In his declining years, when he was too infirm to do hard labor, he frequently remarked that he would give $20 if he could get out "that big boulder in the upper field." The stone he referred to is still there and probably weighs 30 tons.

A pick and crowbar were the principal tools with which Mr. Snyder worked. He must have used draft animals to do some of his haulage, for there are rocks in the base of the fencing that are as large as a kitchen range and weigh up to 3 tons. When he came to a boulder that was too big to handle intact, he drilled a hole in it with hammer and chisel and blasted it into pieces with black powder.

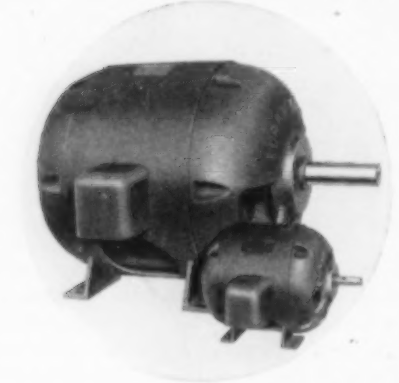
Innumerable other farmers of those early days must have followed the same tedious procedure, for stone fences abound in many of the states where the ground was originally rocky. Later settlers robbed them in many instances, having found them convenient sources of desirable wall material for homes and barns.

PHOTO, WASHINGTON (N. J.) STAR

**A FENCE THAT WILL ENDURE**

Section of 2½ miles of stone fences that a New Jersey pioneer farmer spent 40 years in building, using rocks obtained in clearing the land. The fences not only inclose the 12-acre tract but also divide it into fields and segregate the barnyard.

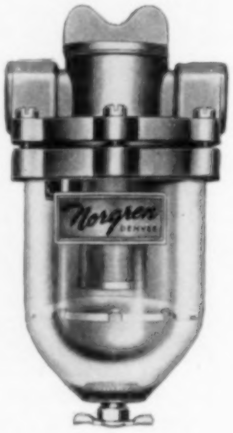
# Industrial Notes



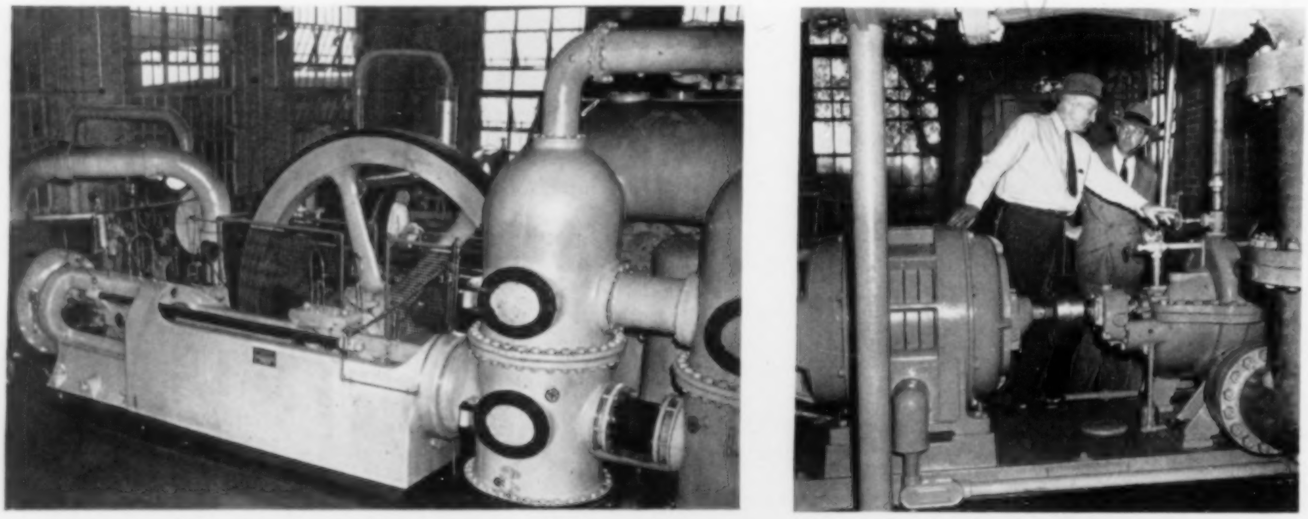
In its new line of Series D induction motors, the Burke Electric Company has followed its traditional policy of generous-proportion design, according to a recent announcement. Frame sizes range from 203 to 505. For those up to 365, the rotor winding is of 1-piece cast aluminum embedded in entirely closed, skewered slots, with rotor punchings of high-grade electrical sheet steel securely anchored to the shaft. Circulation of cooling air is effected by integrally cast fans. For frame sizes 404 to 505, the construction differs only in that the rotor winding is of the copper-bar type embedded in partially closed slots and that ample fan action is induced by extensions of the copper strips. Bar ends are brazed to rings to prevent displacement. Each rotor is balanced dynamically after assembly to insure smooth, quiet operation. All ventilating openings are below the center line and air is taken in at both ends, where baffles direct it around the windings and out through large side openings between the feet. Motors are designed either for sleeve bearings or for double-sealed ball bearings that require no lubrication during machines' service life. The new line of drip-proof, 3-phase, 60-cycle squirrel-cage motors is available in three types: NAD—normal starting torque, low starting current; NED—high starting torque, low starting current; and NCD—high starting torque, high slip.

Radiators and motors of trucks and tractors and industrial engines can be kept permanently free of scale, it is claimed, by Butler AT-1, a self-energizing, electronolytic device. It is a product of Butler Engineering Company and fully automatic, requiring no chemicals, wiring, or switches. It is easy to install and is said to operate efficiently for a year or a minimum of 25,000 miles.

Trouble experienced in sinking grout holes in concrete that needed strengthening has given the contractor a new instrument by which he can spot embedded reinforcing bars and prevent them as well as the drills from being damaged. That's what happened in drilling holes in the 2-foot thick lining of the outlet tunnel of Anderson Ranch Dam near Boise, Idaho. The detector was developed by C.R. Daum and L.T. Cleaner at the Denver Laboratories of the U. S. Bureau of Reclamation, and consists of an electromagnet, an electronic amplifier, and earphones. It enables an operator to locate bars within one inch by an increase in sound intensity.



C. A. Norgren Company has designed and in production a new type filter for the removal of oil emulsion, moisture, and solids from compressed-air lines. Moisture is separated from the air by centrifugal force, a double, right-angle inlet imparting violent swirling motion to the air as it enters the filter bowl. The latter is made of a transparent plastic and is divided into an active and a quiet zone by a thin baffle also of transparent plastic and with holes on its periphery. In the active or separator zone the moisture is thrown forcibly against the wall, where it collects and runs down into the quiet zone. There it is allowed to accumulate instead of being driven along with the air. Centered in the bowl and directly above the baffle plate is a 200-mesh screen of reinforced Monel wire



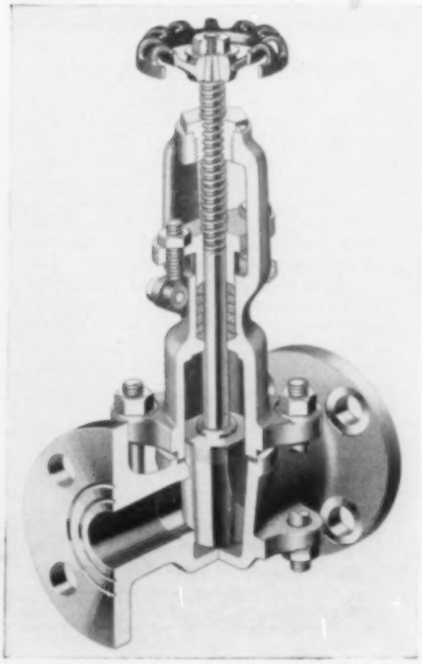
PROGRESS IN PUMP DESIGN

These pictures show comparative sizes of old and new pumping units in the McNeil Street Station of the Shreveport, La., water-supply system. An idea of the dimensions of the venerable reciprocating unit at the left may be gained from the fact that the flywheel of its steam-engine driver is 18 feet in diameter and weighs 10 tons. The size of the recently installed Ingersoll-Rand motor-driven centrifugal pump may be gauged by the men standing behind it. Despite its relatively small dimensions the new machine will handle 6,000,000 gallons a day, as against the big pump's 8,000,000 gallons. The costs of the two units were somewhat in proportion to their sizes: $85,000 for the old one and $8,000 for the new one, or $77,000 less. In the view above, the public-utility commissioner of Shreveport, Joe C. Pratt, is being shown the new centrifugal pump by Plant Engineer Earl O. Mottet of the water department. Mottet has christened the unit "Joe" in honor of the commissioner.

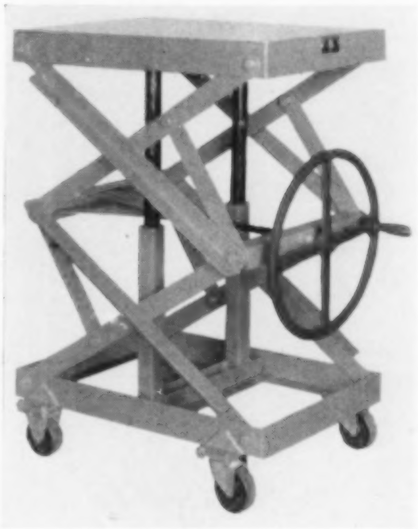
which removes any entrained solids from the air as it leaves the filter. The muck in the quiet zone is drained off through a bottom cock, the transparent bowl enabling the operator to see when this is required. The filter is made in three sizes —¼, ⅜, and ½ inch—with all parts interchangeable except the body.

To lessen fatality of snakebite in field operations, there is now available a kit containing everything a victim needs to treat himself, if necessary. Although of vest-pocket size, it includes an easily applied tourniquet, a suction pump that can be operated by one hand, a tapered adapter by which venom can be withdrawn from a finger or toe, an incision knife to open the wound, a hermetically sealed iodine brush for sterilizing the wound, adhesive compress dressings, and sealed ammonia inhalants for treatment of shock.

Crane Company has announced a new line of corrosion-resistant plug gate valves which are unique in that they combine the advantages of the two most important basic types of valves. They not only provide straight through flow in the wide-open position, as do conventional gate valves, but also are suitable for throttling service, for which the familiar globe valve is designed. Extensive tests conducted in the Crane Research Laboratories and in the field have established, according to the manufacturer, that the plug gate valve offers little resistance to flow when wide open, having a maximum discharge equal to that of a wedge gate valve and about twice that of a globe valve; permits close throttling at both high and low velocities; when in throttled position has a resistance to the cutting action of the fluid equal to that of the plug-type globe valve; and has no tendency towards galling or towards sticking in the closed position even though it be shut while hot and opened when cold. Of outside-screw-and-yoke design, the new Crane valves have bolted bonnet joints and are available in either 18-8 Mo or Monel metal with screwed or flanged ends in sizes from ½ inch to 2 inches. For particular corrosive conditions they can be made of other alloys to customer's specifications.



Built to handle heavy loads, the portable elevating table illustrated is said to lighten labor in machine shops, tool rooms, die departments and elsewhere where weighty equipment has to be moved back and forth between storage and working places. It is of sturdy all-steel construction and designed to lift and carry one ton with safety. Table top measures 20x32 inches. Each revolution of the hand wheel raises it ⅜ inch for a distance of 17 inches, or to a point 43 inches above floor level, and it remains fixed in any position. Two of its casters are stationary, the other two are of the ball-bearing swivel type. With it, says the manufacturer, one man can easily transfer dies from storage shelves to presses and put them in place, rearrange parts in stock room, and do other heavy handling jobs. Table also can be used to support and level overhanging pieces of work on drill presses, etc.



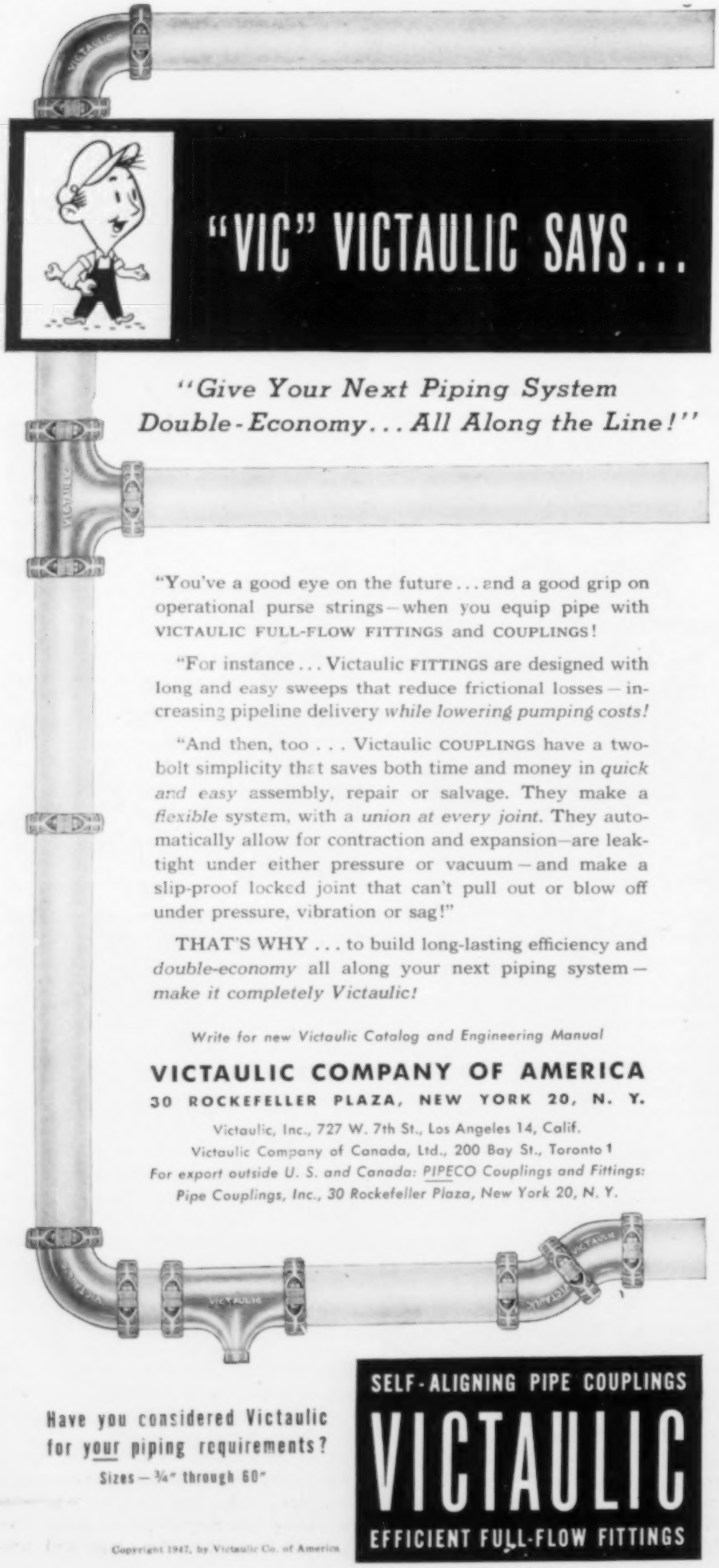
Sensitive control of feed water for boilers is made possible, we are informed, by the use of a compact device developed by the J. A. Campbell Company. Known as the Micro-Netic, it consists essentially of a ball float of Monel metal capable of resisting a pressure of 400 psi., of Alnico permanent magnets that can lift 100 times their own weight, and of a microswitch. The float carries a steel ring which attracts the magnets when it enters their fields. When the water in a boiler drops to a predetermined level, magnetic action opens the water line; when the water has risen to a certain point, the feed line closes automatically. The unit weighs only 7½ pounds and occupies little space on a boiler—the controller in its housing measuring 3.5x7.5 inches and the associate switchbox, 2x4x6.5 inches.

MICRO-NETIC
J.A. CAMPBELL CO
DESIRED
WATER LEVEL

Molybdenum seamless tubing up to 9 inches long and ranging in outside diameter from 0.04 to 0.5 inch, is being made in commercial quantities by the Callite Tungsten Corporation. Although slightly affected by nitrogen, the tubing is said to be resistant to hydrofluoric acid, potassium, and sodium hydroxide. Product can be machined, worked, and welded to iron, nickel, and similar metals.

CorOdex is a liquid rust remover that has recently been put on the market by Allied Products Company. Applied by cotton swab or brush without rubbing it is said to dissolve coatings as thick as ¼ inch and to penetrate pits, crevices, and corners. Long immersion leaves surfaces with blue-black oxidized finish that offsets further rusting. Other claims made for the fluid are that it is noninflammable and noninjurious to the skin.

At the Naval Air Material Center in Philadelphia, Pa., it is the practice to clean bolt holes in structural parts before checking them for size by plug gauges. This operation was formerly done by emery cloth wrapped around wooden dowels. These were inserted in the holes and turned by an electric-drill motor. It was an unsatisfactory and time-wasting procedure because the abrasive had to be replaced frequently and sometimes caused damage. Now the bore holes are conditioned by a round, brass-wire gun-cleaning brush rotated by a portable pneumatic tapping machine. The new method was conceived by a worker under the Navy Employees Suggestion Program and pre-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Have you considered Victaulic for your piping requirements?
Sizes—¾" through 60"

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VICTAULIC
EFFICIENT FULL-FLOW FITTINGS

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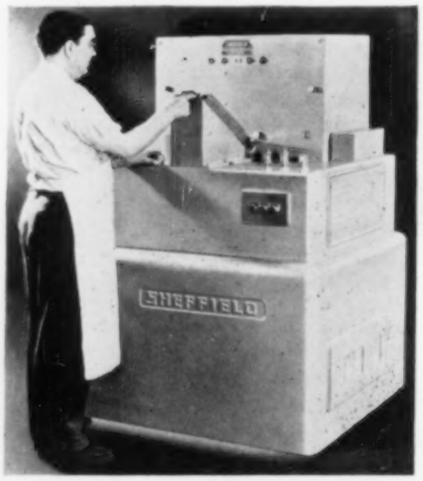
pares the holes for gauging in less than half the time previously required and at an estimated saving of $600 a year.

---

Hardened steel hammers that strike in midair, a built-in trap that extracts foreign matter, and gravity or pneumatic ejection are features of a new heavy-duty hammer mill designed by Buffalo Hammer Mill Corporation for crushing, grinding, pulverizing, shredding, defiberizing, or otherwise reducing mateials of varying sizes and ranging from rock, steel, and iron to wood, food, plastics, etc. Delivering shattering blows to materials while in suspension has advantages over the usual method of reduction through attrition. By eliminating friction that generates heat, less power is required to operate the unit, says the builder, and there is also less wear to cause breakdown. Mill has several removable breaker bars revolving from 1000 to 7500 times a minute and provided with reversible 4-edge hammers of varying thickness. It is available in ½- to 200-hp. standard and special models.



**CHECKS PISTONS QUICKLY**

This "Airlectric" automatic gauging machine checks the average outside diameter of shock-absorber pistons and segregates them into eight size classifications at the rate of 3600 per hour. It was developed by the Sheffield Corporation of Dayton, Ohio. After being ground, pistons are delivered to the machine operator on a conveyor. He puts them in a chute, at the bottom of which is an electric gauging head that rejects excessively oversize units. These go back for regrinding. The others are inserted one by one in a tungsten-carbide air ring, which is connected to a series of "Airlectric" gauging heads that determine the size of each part and light a colored globe that indicates the size. There are five lamps of different colors to designate different acceptable sizes within the minimum and maximum tolerance limits. Oversize and undersize pistons will not light any globe. Upon being ejected from the air ring, the pistons are classified as undersize, oversize, and acceptable, and the latter are further separated according to size into five groups.

## Industrial Literature

A catalogue that lists and briefly describes some 200 standards covering safety and industrial health is obtainable from American Standards Association, 70 East 45th Street, New York 17, N. Y.

Materials for maintenance of industrial and public buildings, hotels, etc., are discussed in detail in a new 32-page catalogue issued by Continental Asbestos & Refining Corporation, 1 Madison Avenue, New York 10, N. Y.

Continental Air Filters, Inc., Louisville, Ky., has issued Bulletin No. 101 which describes and illustrates its Whirlwind oil-bath air cleaner. This unit is applied to cleaning intake air for air compressors and oil and gas engines.

Any speed of drive from 0 to 800 rpm., can be obtained from a constant-speed power source with a new speed selector developed jointly by Speed Selector, Inc., and B. F. Goodrich Company. It makes use of planetary motion, with four variable-pitch sheaves and two V-belts. The three models available are for respective outputs of ½, 1, and 2 hp. A descriptive bulletin is obtainable from B. F. Goodrich Company, Akron, Ohio.

The Logan line of air-control valves, which are now made in 79 models, is described in a new 48-page bulletin issued by Logansport Machine Company, Logansport, Ind. These valves may be applied to various types of manufacturing and processing machinery to expedite the execution of many operations.

Electronic control of temperature, voltage, current, speed, signaling, and other variables in process work is discussed in a 20-page, 3-color publication, *Wheelco Electronic Controls*, that may be obtained from Wheelco Instruments Company, 847 West Harrison Street, Chicago 7, Ill. It is claimed that the application of the electronic principle produces faster and more accurate results than any other type of control system.

Bulletin No. CS-23 of Mine Safety Appliances Company describes new air-line respirators designed to protect workers in any atmosphere that is not immediately harmful to life. Air is fed to either of two types of facepieces through a hose take-off from the mine or plant compressed-air distribution system. Pressure of the air is reduced to within the range of 8-15 psi. before reaching the hose line, and the volume entering the mask is controlled by a valve that admits at least 2 cfm. regardless of its setting. The bulletin may be had from the manufacturer at Braddock, Thomas, and Meade Streets, Pittsburgh 8, Pa.

The war put aluminum in the category of abundant metals and greatly expanded its field of service. In many of aluminum's applications, the thin oxide film that forms on its surface is adequate for satisfactory performance. Where the oxide may be attacked by corrosive substances, however, it has to be given a protective coating. Many finishing materials and methods of applying them have been developed in recent years. To disseminate information concerning them, Reynolds Metals Company, 2500 South Third Street, Louisville 1, Ky., has published *Finishes for Aluminum* in two sections. Section 1 discusses the various kinds, their characteristics, and their application. Section 2 gives detailed information on shop practices. The price of the two volumes is $2.00.

**YOU'RE SAFE**
**With *NAYLOR***
**in**
**Mining Service**

The safety factors built into Naylor light-weight pipe have made it outstanding in the mining field. The exclusive Lockseam Spiralweld provides the reason. Acting as a continuous expansion joint, this structure absorbs shock loads, vibration, expansion and contraction . . . insuring closer conformity to topographical conditions without any sacrifice of strength. For high pressure hydraulic lines, high and low pressure air lines, de-watering and drainage lines, ventilating lines, water supply lines and sludge lines, it will pay you to specify Naylor light-weight pipe.

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# MOST COMPLETE LINE

## of DROP FORGED STEEL VALVES, FITTINGS & FLANGES

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WIRE!

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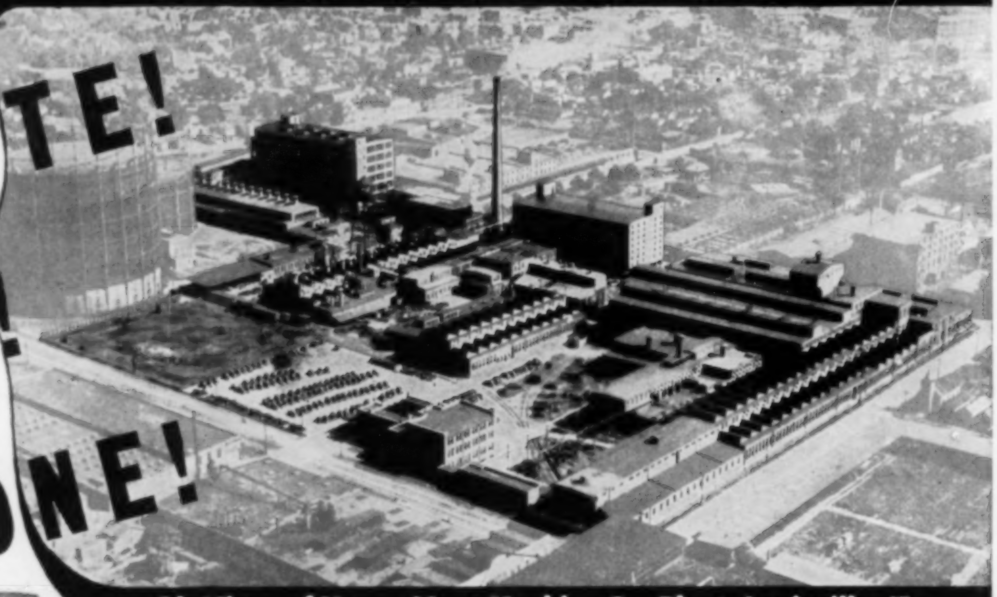

*Air View of Henry Vogt Machine Co. Plant, Louisville, Ky.*

VOGT provides one convenient, economical source of supply with the most comprehensive line of drop forged steel piping materials anywhere available to industry. Here will be found everything needed for the safe and efficient control of oil, steam, water, air, gas, and ammonia at high or low pressures and temperatures.

More drop forged steel Valves, Fittings and Flanges are made by Vogt, and deservedly so, because Vogt makes them better!

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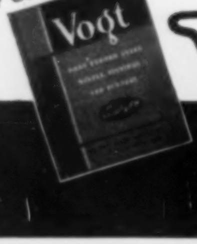
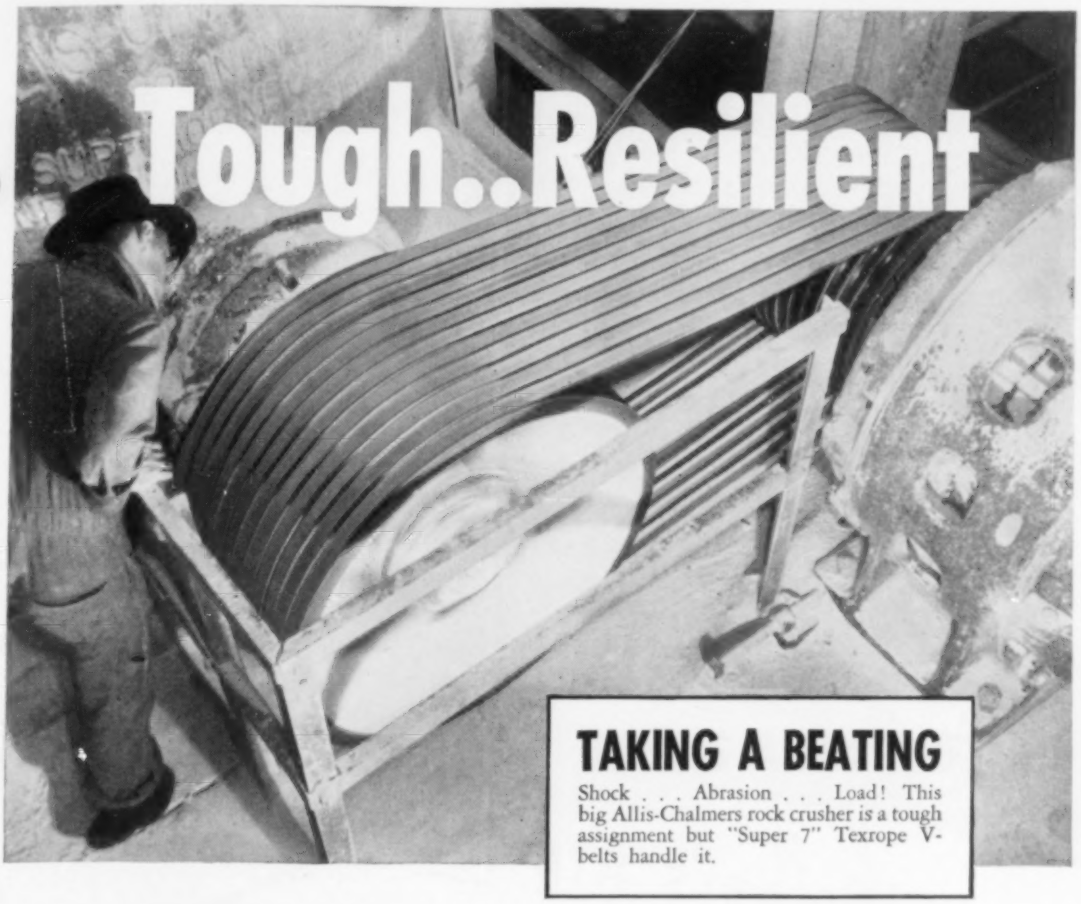


**Vogt**

**DROP FORGED STEEL VALVES, FITTINGS AND FLANGES**



**TAKING A BEATING**

Shock . . . Abrasion . . . Load! This big Allis-Chalmers rock crusher is a tough assignment but "Super 7" Texrope V-belts handle it.

## . . . *You get 7 Great Features in "Super 7" Texrope V-Belts*

**1. TOUGHER COVER.** Two layers of tightly woven long-staple cotton fabric and tough, wear-resistant rubber compound. Protects the belt carcass from grit, moisture and wear — holds its shape — assures maximum belt life.

**2. SHOCK ABSORBING.** "Super 7" belts combine great strength with the degree of resiliency necessary for long life and smooth power transmission.

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**4. STRONGER CORDS.** More cords—imbedded in cool-running rubber compound. A powerful load-carrying structure.

**5. PRECISION CURED** in pressure molds to assure accurate section and perfect bonding of cords, cover and cushion.

**6. ACCURATELY MATCHED.** Every belt weighed, measured and carefully inspected before being sized and packed.

**7. ENGINEERING LEADERSHIP.** "Super 7" Texrope V-belts represent 22 years of research and experience — by Allis-Chalmers, originator of the Multiple V-belt drive.

"Super 7" Texrope V-belts come in five types to meet every operating requirement: *Standard — Heat Resisting — Oil Resisting — Oil Proof* and *Static Resisting.* Call your Allis-Chalmers office or dealer. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

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## TEXROPE ..Greatest Name in V-Belt Drives

**"Super 7" V-BELTS**
Five Types — Sizes to suit every power transmission job.

**Texsteel, Texdrive, "Magic-Grip"**
— sheaves in a full range of sizes, grooves.

**"Vari-Pitch" SHEAVES**
Exact variations in speed, stationary or motion control.

**SPEED CHANGERS**
Speed variations up to 375% at the turn of a crank.

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Finest V-Belt engineering talent in the world—at your call.

TEXROPE "Super 7" V-Belts result from the cooperative research of two great companies — Allis-Chalmers and B. F. Goodrich. They are sold only by A-C.

**Refer to Sweet's Catalog.**

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**One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products**

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A CENTURY OF SERVICE
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THAT MADE
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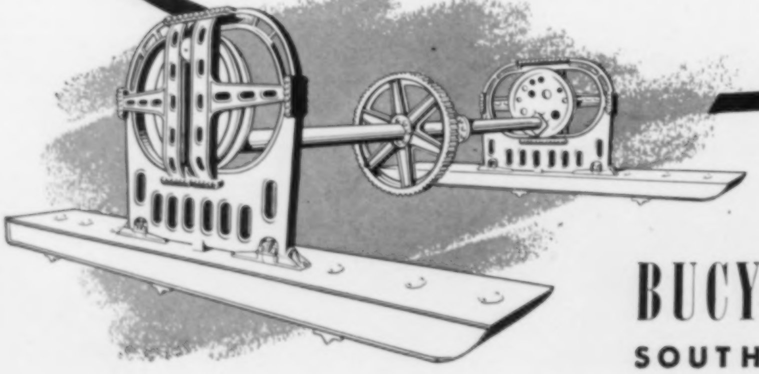
# WHERE OTHER MACHINES CAN'T HOPE TO TREAD...

## Bucyrus Walkers Are Moving Dirt

All over the world, Bucyrus-Erie walking draglines are handling jobs that machines with other types of mounting can't undertake because of the ground conditions prevailing. Bucyrus-Eries are sure-footed and safe even in precarious places. They can walk where you want them, when you want them — waste no time in getting from one digging position to the next, work close to the edge of steep banks for extra range.

Bucyrus-Erie design provides the needed stability — in both digging and walking. The large circular base provides a working foundation whose rim pressures are always safely low because shifts of the center of gravity are never permitted to go beyond predetermined limits. The big walking shoes grip the ground firmly, and the simple rolling cam walking action provides a motion that cushions the machine down at each step.

25M47



**Booms: 110 to 250 ft.**
**Buckets: 4 cu. yd. to 25 cu. yd.**

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# USE IR OVERHEAD AIR HOISTS

Lifting and lowering operations over chemical vats, pickling, plating and washing tanks, heat-treat chambers, etc., call for a hoist with a motor that will give dependable performance regardless of a wet—hot—gaseous or dusty atmosphere.

You can put Ingersoll-Rand Overhead Air Hoists to work under practically any condition and know that there will be no time lost for repairs. Clean compressed air is piped into a completely sealed, piston-type air motor operating in a bath of oil. The exhaust air helps to improve the atmosphere.

Another valuable feature is the throttle control. A range of speeds from a smooth creep to full throttle is the answer to more output where accuracy and smoothness is required. Units are available from 200 to 20,000 lbs. capacity.

8-993

**Ingersoll-Rand**

# FOR RELIABILITY IN HOT GASEOUS ATMOSPHERES

Write for the new bulletin,
Form 5020, *"Hoist and Haul with Air Power."*
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

**COMPRESSORS · AIR TOOLS · ROCK DRILLS · TURBO BLOWERS · CONDENSERS · CENTRIFUGAL PUMPS · OIL & GAS ENGINES**

WHICH ROPE IS BEST ?
It all depends on the job!

THREE OF THE MANY BETHLEHEM WIRE ROPE CONSTRUCTIONS

These are Bethlehem's Type W (IWRC), Type W (fiber core), and Type U (IWRC)—three commonly-used varieties. Each is made for definite jobs, and one will not necessarily do the work of the others. Get specific details from Bethlehem representatives.

Too many people figure that rope is rope, and that what is good for one machine is just as good for another. That's like saying that the mainspring of a wrist watch would work in an alarm clock.

For example, a Bethlehem Type W rope is excellent as a hoist line in many applications. It's designed for this purpose. We seldom recommend it as a dragline. There is another Bethlehem construction (Type U) that is far more suitable for most dragline service.

Similarly, it pays to get the correct size, grade, lay, and core in every instance. Each of those factors is important; each has a bearing on the life of your rope.

Our tip is this: if you aren't *sure* which is the right wire rope for your job, ask a Bethlehem engineer for his recommendations. This specialized service is yours for the asking, and it may save you a lot of grief—and money.

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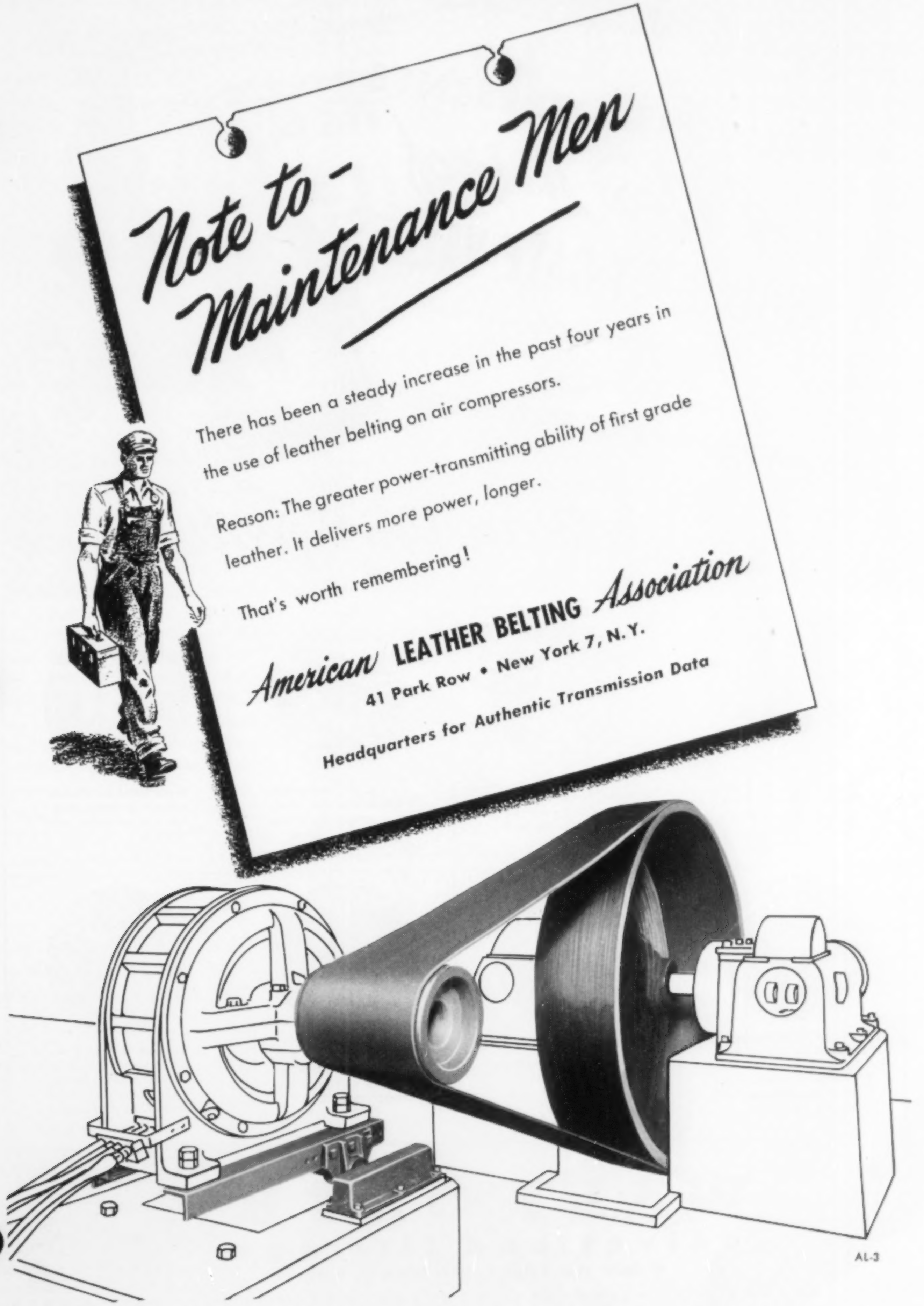
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

*On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation*

***When you think WIRE ROPE . . . think BETHLEHEM***



Note to -
Maintenance Men

There has been a steady increase in the past four years in the use of leather belting on air compressors.

Reason: The greater power-transmitting ability of first grade leather. It delivers more power, longer.

That's worth remembering!

*American* **LEATHER BELTING** *Association*
**41 Park Row • New York 7, N. Y.**

**Headquarters for Authentic Transmission Data**

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*A New Line of*

IRON BODY GATE VALVES

with screwed or flanged ends

6
125 WSP
200 OWG
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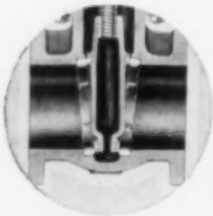
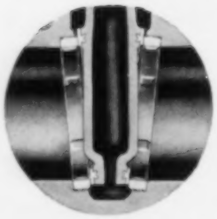
... *8 Outstanding Features*

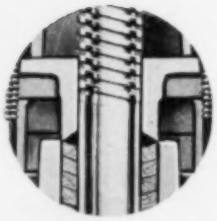


**Straight-Flow Port Design** reduces fluid turbulence to a practical minimum.



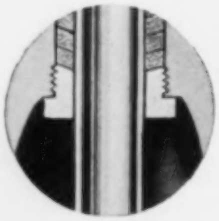
**Seat Rings** of end-seated type are screwed into the body.

**Sure-Grip Malleable handwheel** for non-skid gripping even with heavy gloves.

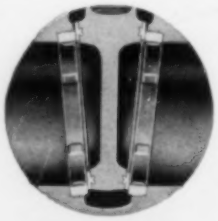


**Brass Liner on Glands** assures greater resistance to corrosion and scoring.

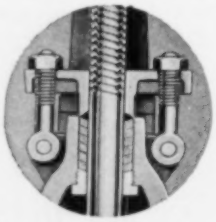
**T-head disc-to-stem connection** on OS&Y types provides stronger connection, prevents loosening of disc by corrosion.



**Bronze back-seat bushings** in bonnets of OS&Y valves.



**Solid Web Type disc** in OS&Y valves for greater strength and longer service.



**Hinged Gland Eye-Bolts** on OS&Y valves permit faster, easier repacking under full pressure.

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

*For Complete Information* on these new Walworth Iron Body Valves, write for bulletin 106.

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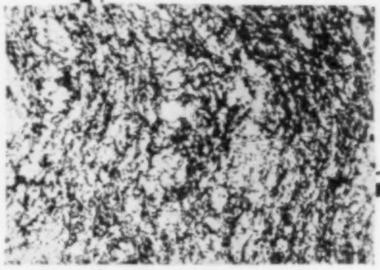
# NEW AIR LINE FILTER

## GIVES SURER, LONGER PROTECTION AGAINST MOISTURE



Magnified Section of Filter Element

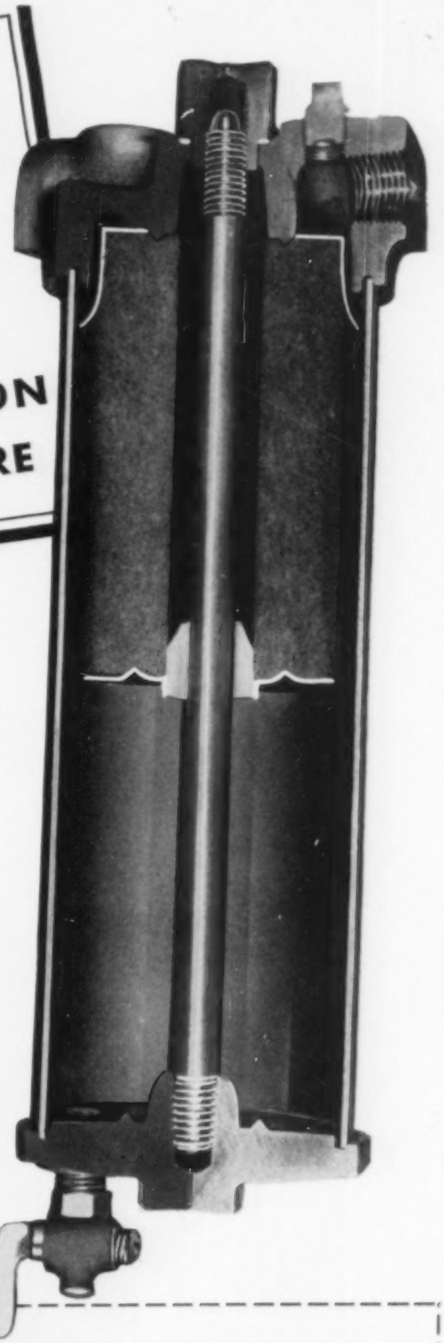
More positive removal of moisture results from a special baffling arrangement plus a newly-developed method of "felting" and impregnating micronic fibres. Moisture not deflected by the baffle is required to make hundreds of sharp turns through the minute interstices, impinging on the hydrophobic fibre structure, then draining freely to the collecting chamber. Channeling is positively prevented by the resinous impregnation.

**Longer replacement-free service** results from non-wicking property of the fibres. Accumulated moisture drains readily into extra-large collection chamber below filtering cartridge. Simple, sturdy housing is quickly disassembled for cartridge replacement by removing single cap nut.

MICRO-KLEAN Compressed Air Filter models now available handle up to 40 cfm of free air at pressures up to 125 psi. Larger capacity units in preparation.

Cuno MICRO-KLEAN Compressed Air Line Filters and replaceable cartridges are manufactured by the company whose filters are used more often in industry than any other brand.

Because it extracts the maximum amount of entrained moisture and dirt without requiring frequent cartridge replacement . . . the new Cuno MICRO-KLEAN is ideal for filtering compressed air under severe moisture conditions.

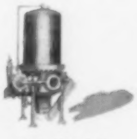


**CUNO**

*Fluid Conditioning*

**REMOVES MORE SIZES OF SOLIDS FROM MORE TYPES OF FLUIDS**

**AUTO-KLEAN**
General service down to .0035" Disc-type. Continuously cleanable.



**FLO-KLEAN**
For highly abrasive solids down to .0025". Wire-wound. Continuously cleanable.

**MICRO-KLEAN**
Micronic-type. Impregnated fibre. "Graded Density in Depth" cuts replacement cost.

**COOLANT-KLEAN**
Low-cost unit filtration of grinder coolant. Fabric-type element.

**SEND COUPON FOR FREE FACTS TO FIT YOUR INSTALLATION**

**CUNO ENGINEERING CORPORATION**
1710 South Vine Street,
Meriden, Conn.

Please have nearest Cuno representative provide information on Cuno Model 1B1G Compressed Air Filter.

Name .................................... Title ....................................

Company ..........................................................................

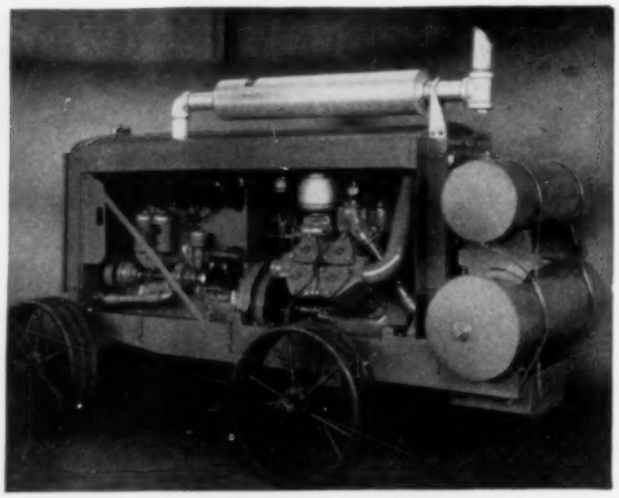
Address ...........................................................................

**Less Pressure Drop**

Norgren Regulators reduce and regulate air power *with less pressure drop* than conventional regulators. Baffle plate action permits decisive opening and closing . . . protects diaphragm. For air, oil, steam, water and noncorrosive gases. For primary pressures to 400-lb. psi; secondary pressures from 5 to 250-lb. psi.

Write for catalog 400. C. A. Norgren Co., 222 Santa Fe Drive, Denver 9, Colorado.

**Norgren**



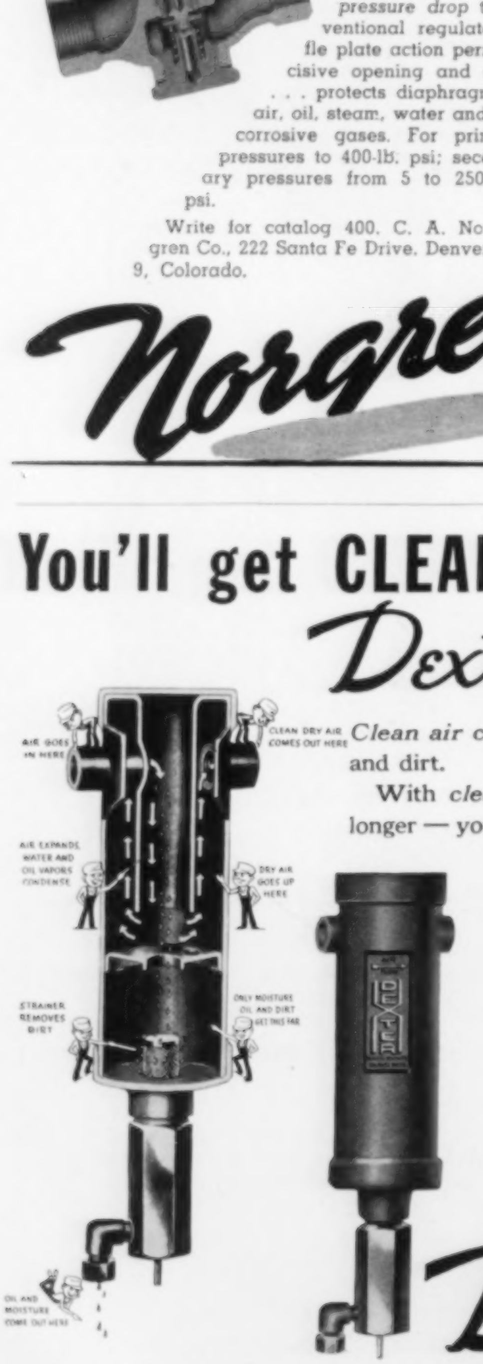
**MAXIM EQUIPPED FOR GOOD PUBLIC RELATIONS**

A portable compressor is apt to spend its service life in many locations where noise is a nuisance to nearby homes and offices. It is good public relations to provide adequate silencing and good practice to choose Maxims for this job. For superior silencing of engine exhaust and intake, compressor intake, steam or air blow-off; for spark arresting or silencing with the heat recovery feature, specify Maxims. Detailed bulletins on request.

**THE MAXIM SILENCER COMPANY**
61 HOMESTEAD AVENUE, HARTFORD 1, CONN.

**MAXIM SILENCERS**

**You'll get CLEAN AIR CONTINUOUSLY with a Dexter AUTOMATIC AIR SEPARATOR**


AIR GOES IN HERE
CLEAN DRY AIR COMES OUT HERE
AIR EXPANDS WATER AND OIL VAPORS CONDENSE
DRY AIR GOES UP HERE
STRAINER REMOVES DIRT
ONLY MOISTURE OIL AND DIRT GET THIS FAR
OIL AND MOISTURE COME OUT HERE
DEXTER

*Clean air continuously* means compressed air that is *always* free from water, oil and dirt.

With *clean air continuously* your pneumatic tools will work better and last longer — your cleaning, blasting and spraying will be free from spoilage — your pipe lines will be protected from freeze-ups — *you'll operate more economically.*

The Dexter Air Separator positively removes oil, water and dirt from compressed air lines and (through the patented Eliminator) expels them continuously from the system. It is extremely simple, with *no* filter pads to replace — no bearings or whirling gadgets — no trap or vent cock to be opened at frequent intervals. It's *automatic.*

**IMMEDIATE DELIVERY**

All popular sizes are available for immediate delivery — *at less than pre-war prices!* Write today for a copy of the valuable and comprehensive bulletin "Clean, Dry Compressed Air."

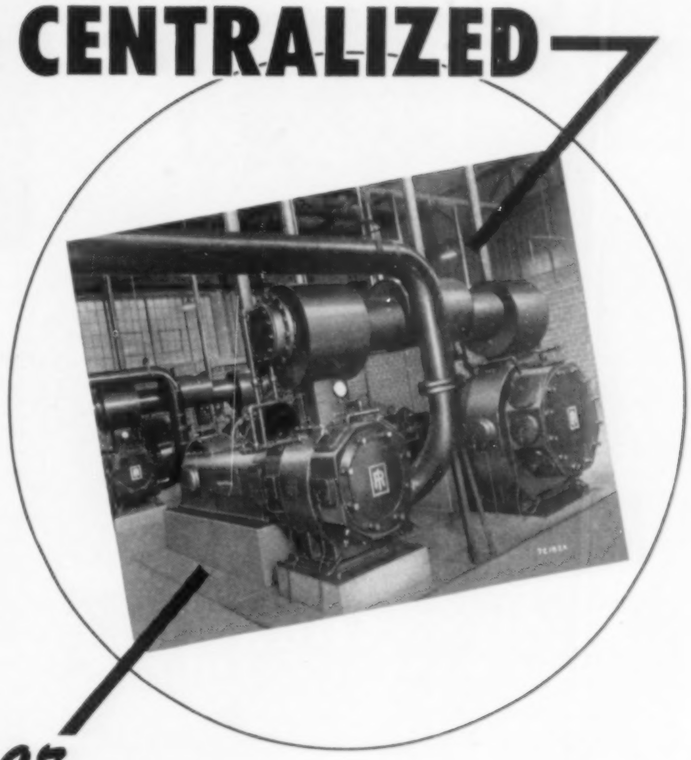
**THE LEAVITT MACHINE COMPANY**
**130 E. River Street, Orange, Mass.**

S-72

**Dexter AUTOMATIC SEPARATORS**

ALSO MAKERS OF DEXTER VALVE RESEATING MACHINES
ATHOL PLUMBING SUPPLIES AND DEXTER LATHE CHUCKS.

# Should your AIR-POWER system be CENTRALIZED—



# or DECENTRALIZED?

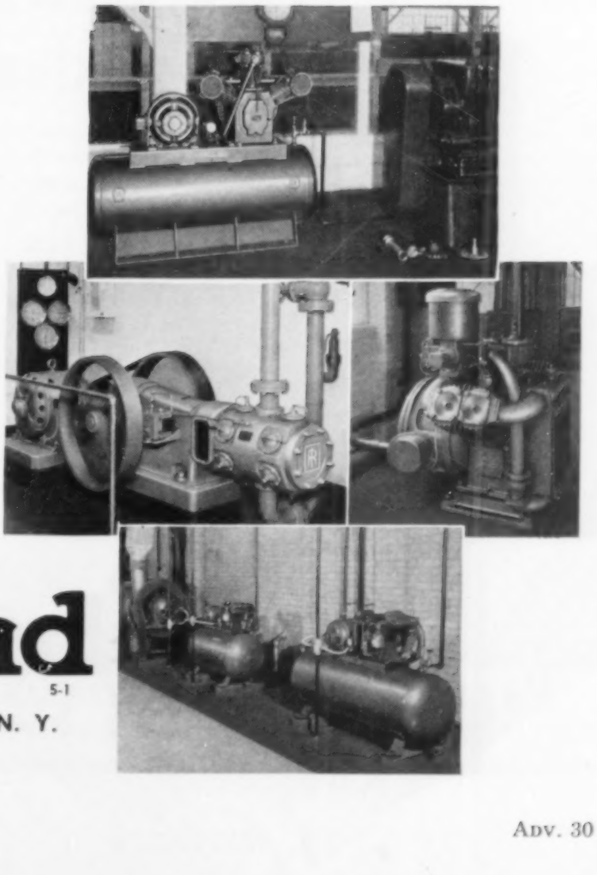
If you have a shop where you need Air Power at scattered or isolated spots, your first impulse may be to install a decentralized source of Air Power . . . a small compressor at each location. But before doing this, consider these points:

| | |
|---|---|
| **Flexibility** | **Load Factor** |
| **Power Rate** | **Piping System** |
| **First Cost** | **Attendance** |
| **Installation** | **Maintenance** |

For example, during certain hours, seasons, or cycles, the maximum demand for air may shift from one part of your plant to another. If you had a central compressor plant with an adequate piping system, the full capacity of your entire plant could be made available to *any* section of the shop at *any* time. You may find that part of shop should have a centralized system, the other decentralized, or a combination of both systems.

• • •

➡ When you plan a new plant or an extension, or feel that it's time to modernize your system, call in an Ingersoll-Rand engineer. He's an Air-Power Specialist, and represents a company that builds a complete line of compressors . . . for centralized, decentralized, or combination systems . . . sizes from ½ to 3000 horsepower . . . air-cooled and water-cooled types . . . pressures from vacuums to 15,000 psi. . . . drives by electric motor or built-in steam, gas, or diesel engines.



COMPRESSORS • AIR TOOLS • ROCK DRILLS
TURBO BLOWERS • CONDENSERS
CENTRIFUGAL PUMPS • OIL AND GAS ENGINES

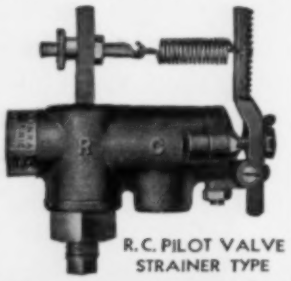
**Ingersoll-Rand**

5-1

IR 11 BROADWAY, NEW YORK 4, N. Y.

## R. C. PILOT VALVES FOR POSITIVE CONTROL

R-C Unloader Pilot Valves (plain or strainer type) are standard on many leading compressors . . . installed as replacements on thousands of compressors in all parts of the U.S.A. and overseas. The R-C valve—positive in action—cannot chatter . . . it's always in open or closed position. Adjustment is provided for any unload-to-load range from 3% to 30% of maximum receiver pressure. Install an R-C Unloader Pilot valve—let performance prove its value. Specify air pressure and range of on-and-off operation desired. Write for price and recommendation.



R. C. PILOT VALVE
STRAINER TYPE

**R. CONRADER CO.**
**1207 FRENCH STREET - ERIE, PA.**

**PILOT VALVES for Portable and Stationary Air Compressors provided with Unloaders**

---

L-56
MINE KING
AIR HOSE
GOODALL RUBBER CO.

## "MINE KING"

Goodall's Long Length
Air Hose . . . with the
Shock-Absorber Cover

A husky hose, built to stay on the job *longer*. Available in extra long engths.

"MINE KING" is a Goodall "Standard of Quality" product, which means maximum service life under severest working conditions. Two important features especially recommend it for mining and construction work—availability in long lengths, and a tough, resilient cover that acts as a shock absorber against falling rock, timbers, tools, etc. *Contact our nearest branch for prices.*

**GOODALL RUBBER CO., INC.**
THE GOODALL-WHITEHEAD COMPANIES
Philadelphia • Trenton • New York • Boston • Pittsburgh • Chicago • St. Paul • Los Angeles
San Francisco • Seattle • Salt Lake City • Houston • Factory: Trenton, N. J. • Est. 1870

---

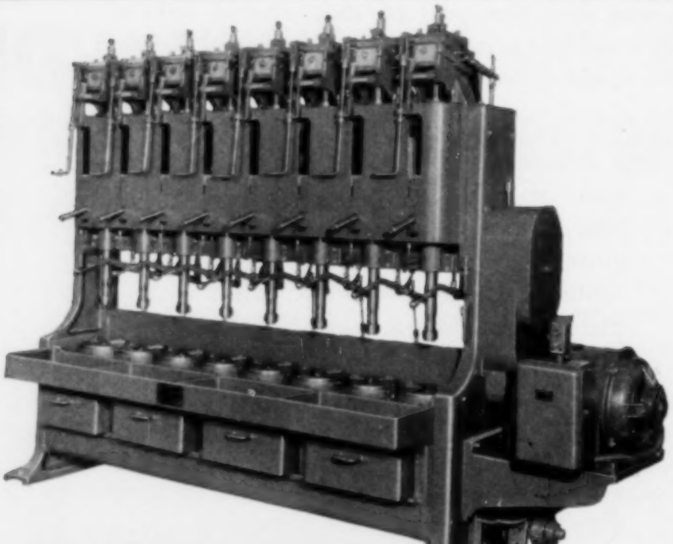
# Pipe-Coupling Tappers Employ NOPAK Cylinders *for* Fast, Positive Chucking

One of the features which contributes to the speed and capacity of Acme Pipe-Coupling Tappers is the self-centering air chucks which grip and position the couplings during the tapping operation.

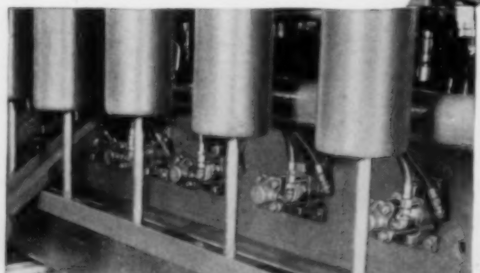
These chucks are individually actuated by NOPAK Air Cylinders mounted behind each spindle. Downward and upward movement of the spindles operates the air valves which control the chucks . . . gripping and releasing the couplings as required, automatically.

This is but one of many applications in which NOPAK Cylinders, Air or Hydraulic, supply the motive power for fast, positive machine movements. Write for Bulletin 92.

**GALLAND-HENNING MFG. CO., 2759 S. 31st St., Milwaukee 7, Wis.**



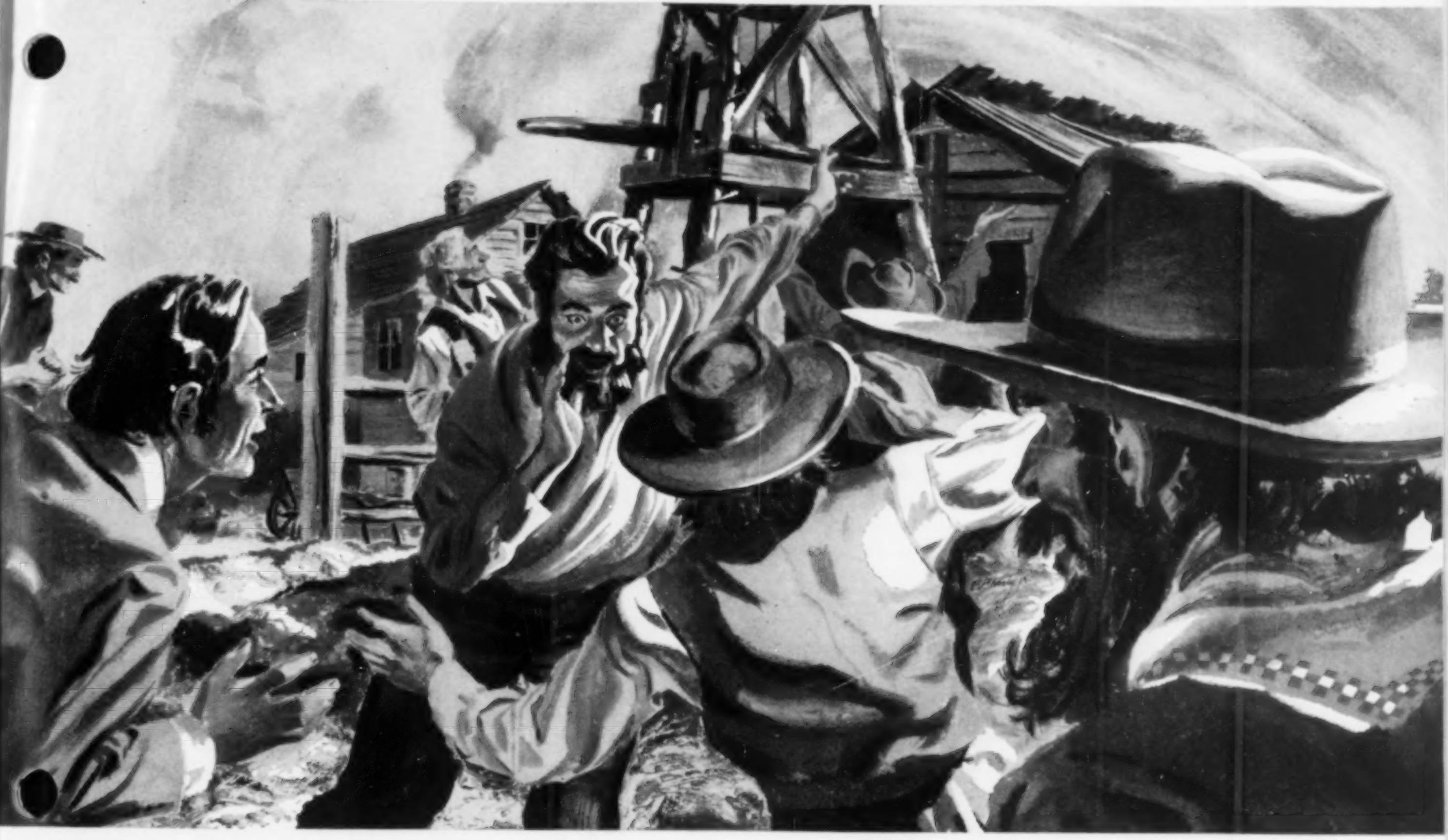
ACME Model XT-C, 8-spindle, Pipe-Coupling Tapper employs 8 — 2" diameter, Model F NOPAK Air Cylinders.

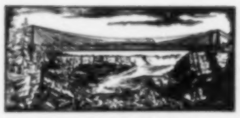


Close-up shows how NOPAK Cylinders are mounted on back panel.

**NOPAK**
**VALVES AND CYLINDERS**
**DESIGNED for AIR and HYDRAULIC SERVICE**

# CONFIDENCE . . . how much is it worth?





EVEN IN THIS ATOMIC ERA, what engineer wouldn't be awed at the possibility of building a bridge of his own design across the hazardous Niagara gorge? Yet John A. Roebling was commissioned to do just that *98 years ago* . . . ten years before this country's first oil well was drilled!

What an outstanding example of confidence. The confidence of a man in his own work. The confidence of people in one man and his abilities . . .

Today this same confidence, that has been nurtured through the years, is still alive in the company founded by this man and his sons. On this same foundation was built a business that has always believed that confidence must be created and grows through completely honest business transactions with each and every one of its customers.

Little wonder, then, that your confidence in John A. Roebling's Sons Company is guarded so carefully.

### Why Plant Men Specify "Blue Center" Steel Wire Rope

BASICALLY, there is but *one* reason: a firm confidence in the Roebling name and reputation, in the Roebling organization and representatives, in the quality of the wire rope itself.

Of course, there are other reasons, too. You have the assurance that the complete range of constructions and sizes in "Blue Center" Steel Wire Rope includes the *right* rope for your installation. And whether it's a preformed or non-preformed type, you can trust it to give you most service for the money.

Let a Roebling Field Engineer advise you on unusual problems of rope selection, operation and maintenance. His knowledge is based on his own experience *plus* field studies, research and thousands of service records studied by Roebling's Engineering Department. Call him at our nearest branch office.

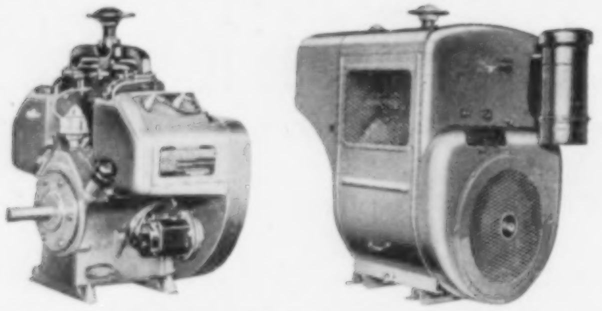
JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
*Branches and Warehouses in Principal Cities*

ROEBLING
TRENTON N.J.

**ROEBLING**

**A CENTURY OF CONFIDENCE**

Manufacturers of Wire Rope and Strand • Fittings • Slings • Screen, Hardware and Industrial Wire Cloth • Aerial Wire Rope Systems • Hard, Annealed or Tempered High and Low Carbon Fine and Specialty Wire, Flat Wire, Cold Rolled Strip and Cold Rolled Spring Steel • Ski Lifts • Electrical Wire and Cable • Suspension Bridges and Cables • Aircord, Aircord Terminals and Air Controls • Lawn Mowers



*Let this 20-Horse Team*

**Handle Your Heavy-Duty Power Jobs**

Turning up 20.5 hp. at 2200 R.P.M. the Model VE-4 WISCONSIN Standard Air-Cooled Engine (left) and the Model VE-4 Complete Power Unit (right), can always be depended upon for continuous, heavy-duty operation in any kind of service, on any kind of equipment within their power range.

Positive, trouble-free AIR-COOLING; dynamically balanced crankshaft mounted on tapered roller bearings, front and rear; high tension magneto with impulse coupling for quick, easy starting in any weather . . . these are features that you can bank on for top performance.

*Specify Wisconsin Air-Cooled Engines for YOUR equipment . . . for most hp.-hours of service, at the lowest overall cost.*

Most H.P. per pound

**WISCONSIN MOTOR Corporation**

MILWAUKEE 14, WISCONSIN, U. S. A.

*World's Largest Builders of Heavy-Duty Air-Cooled Engines*

**FOR AIR COMPRESSORS**

class 9213AH3

**PRESSURE SWITCH**

200 lbs. pressure limit
15 to 40 lbs. differential

• A two-pole device for intermediate-sized motors. Simply-designed, huskily-built mechanism delivers long life and trouble-free operation with a minimum of servicing.

Quickly wired. Range and differential easily adjusted in the field. Offered with or without pressure-release valve for easier motor starting.

*Write for Bulletin* • photos, specifications of Square D pressure switches and related devices. Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wis.

**SQUARE D COMPANY**

DETROIT • MILWAUKEE • LOS ANGELES

DRI AIR MAY BE INSTALLED BY SUSPENDING IT FROM THE PIPING WITHOUT ANY OTHER SUPPORT.

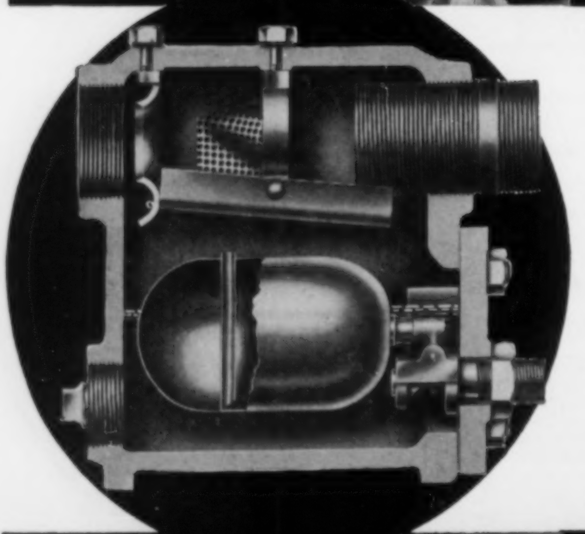
**INCREASED PNEUMATIC EFFICIENCY WITH THIS AUTOMATIC SEPARATOR**

PROTECT EQUIPMENT WITH

**DRIAIR**

SEPARATES • COLLECTS • DELIVERS

• DriAir separates and automatically ejects the condensed water and oil from compressed air lines, collects pipe scale and rust, delivers clean dry air to tools and other pneumatic equipment. This promotes better lubrication, reduces wear, increases life of tools and produces greater output. All internal parts are made of bronze or copper—resistant to corrosion and practically permanent.



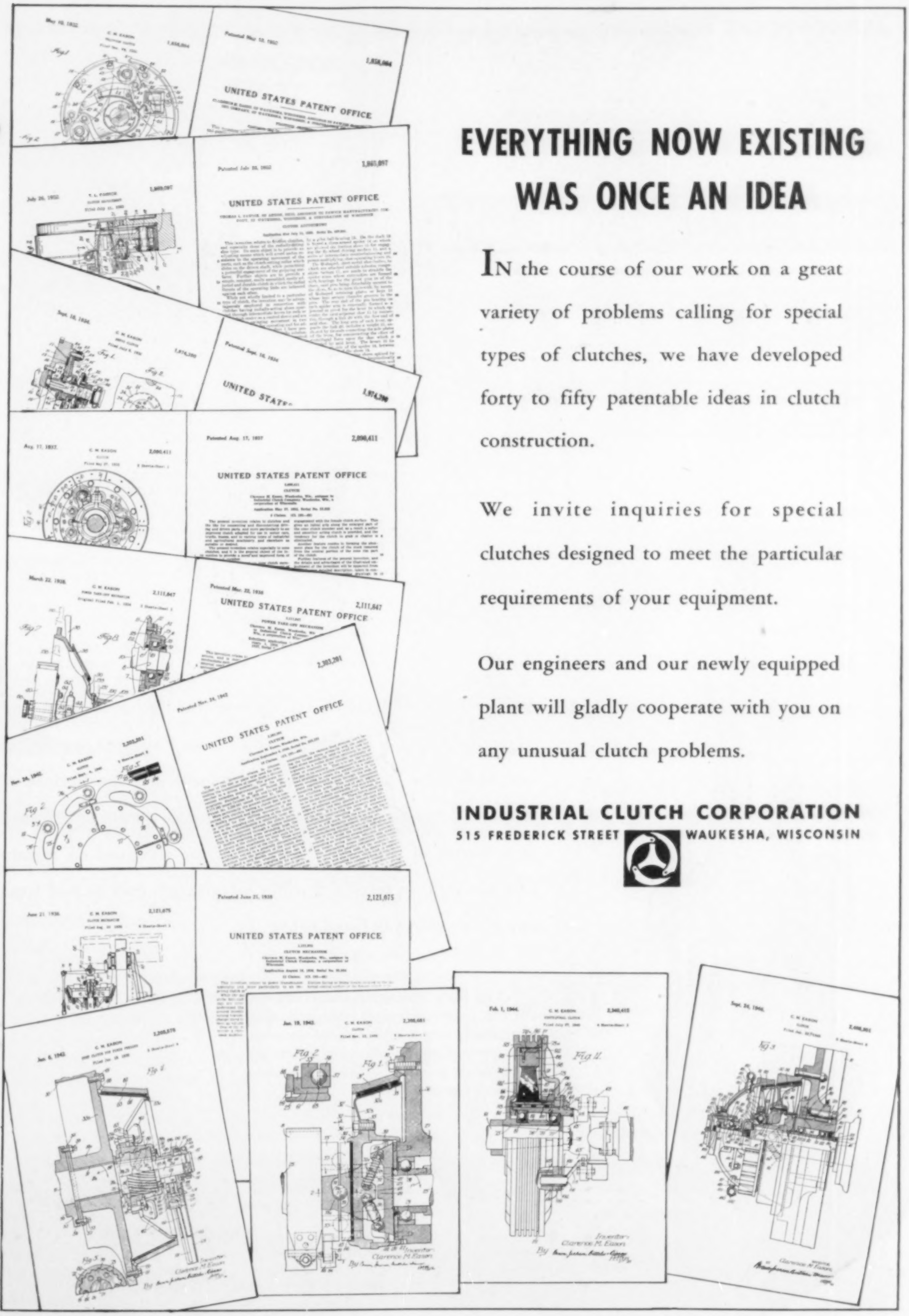
A TYPICAL INSTALLATION SHOWING DRI AIR STANDING ON A CONCRETE FLOOR NEXT TO THE WALL.

WRITE FOR BULLETIN DA WHICH FULLY DESCRIBES THE CONSTRUCTION AND OPERATION OF THE DRIAIR.

**NEW JERSEY METER CO.**

*"SPECIALISTS IN COMPRESSED AIR DEVICES"*

PLAINFIELD, NEW JERSEY



# EVERYTHING NOW EXISTING WAS ONCE AN IDEA

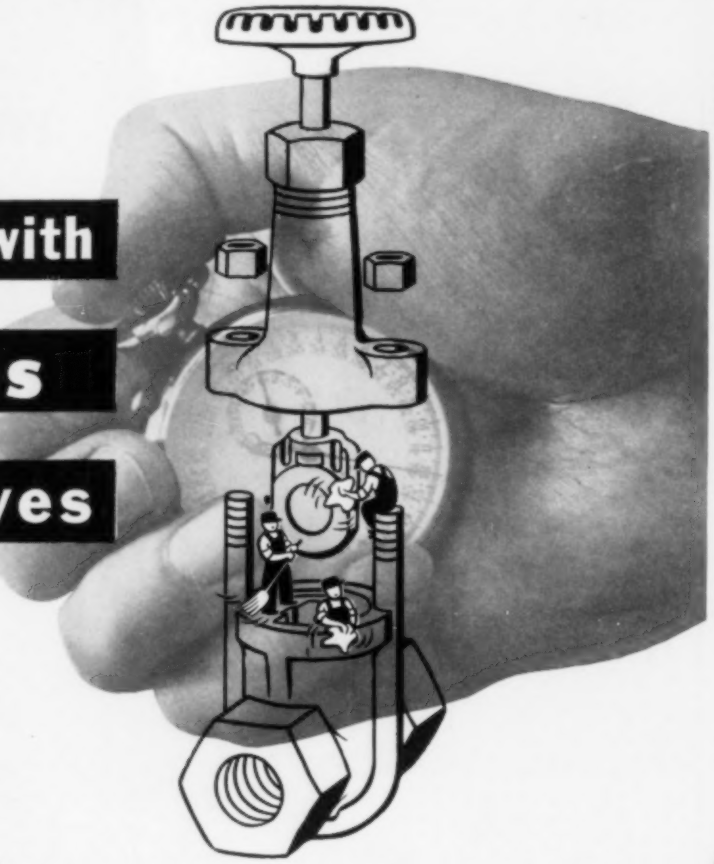
In the course of our work on a great variety of problems calling for special types of clutches, we have developed forty to fifty patentable ideas in clutch construction.

We invite inquiries for special clutches designed to meet the particular requirements of your equipment.

Our engineers and our newly equipped plant will gladly cooperate with you on any unusual clutch problems.

**INDUSTRIAL CLUTCH CORPORATION**
515 FREDERICK STREET WAUKESHA, WISCONSIN

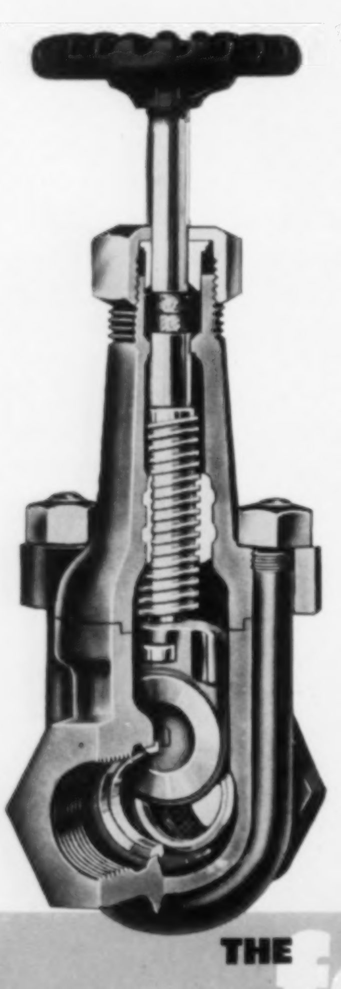
# American industry flows through fairbanks valves



## Shorter Downtime with

## fairbanks

## U-Bolt Gate Valves



Simple assembly is effectively combined with strength and compactness in the Fairbanks U-Bolt Gate Valves to provide an iron body valve for general use that is quick and easy to clean or service. Although dismantling and reassembly are accomplished in a matter of minutes, these valves are designed to remain pressure tight in service. Further information may be had from any of the addresses listed below.

● Fig. 0417 — Iron Body, Bronze Mounted Valve with heavy bronze stem, solid bronze taper wedge and rolled-in bronze seat rings. Also available in All-Iron construction. Both types are made in sizes from ½" through 4". 150 pounds steam pressure — 225 pounds water, oil or gas pressure, non-shock.

**THE fairbanks COMPANY**

393 Lafayette Street, New York 3, N. Y.

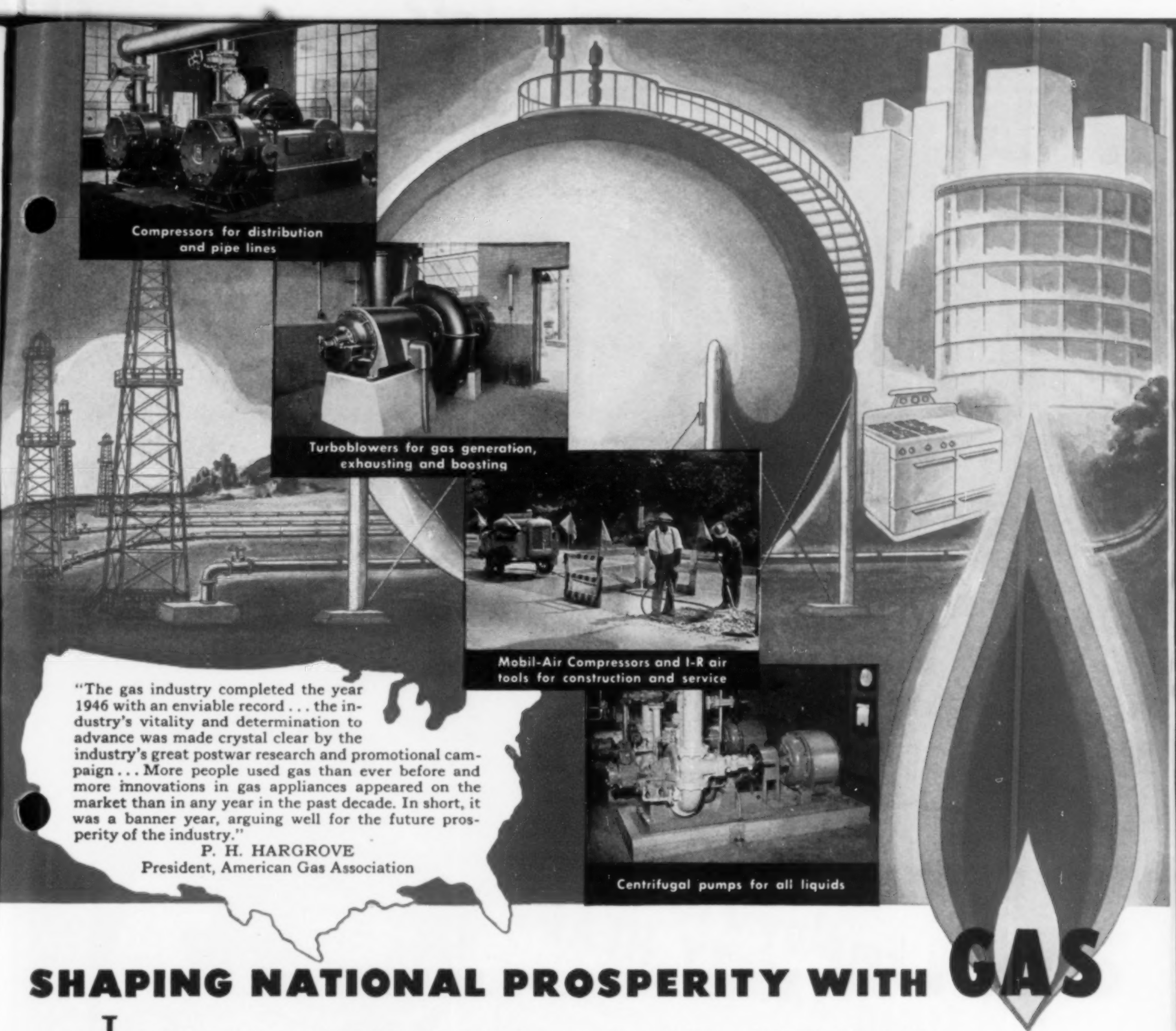
520 Atlantic Avenue
Boston 10, Mass.

15 Ferry Street
Pittsburgh 22, Pa.

748 M & M Building
Houston 2, Texas

202 Division Street
Rome, Ga.

5141



Compressors for distribution and pipe lines

Turboblowers for gas generation, exhausting and boosting

Mobil-Air Compressors and I-R air tools for construction and service

Centrifugal pumps for all liquids

"The gas industry completed the year 1946 with an enviable record . . . the industry's vitality and determination to advance was made crystal clear by the industry's great postwar research and promotional campaign . . . More people used gas than ever before and more innovations in gas appliances appeared on the market than in any year in the past decade. In short, it was a banner year, arguing well for the future prosperity of the industry."

P. H. HARGROVE
President, American Gas Association

# SHAPING NATIONAL PROSPERITY WITH GAS

In serving 24 million residential and industrial customers the Gas Industry contributes substantially to our National Prosperity.

These users pay nearly 1¼ billion dollars annually for the benefits and comforts of gas service—heating, cooking, refrigeration, power and hundreds of manufacturing processes . . . This revenue gives employment to 112,000 people—indirectly to thousands more in factories that make gas appliances and the machinery that generates and distributes the gas.

The constant growth of the Gas Industry is proof that it is alert to the expanding needs of the Nation. In the four years, 1946-1949 it is estimated that one billion dollars will be spent for expansion of gas production, transmission and distribution facilities.

Gas must be piped all the way, some from the large urban manufactured gas plants, some for thousands of miles from our natural gas fields. Compressors and Turboblowers furnish the pressure required for these transmission and distribution lines . . . There is an Ingersoll-Rand Compressor and Turboblower for every condition— for high or low pressure, for small or immense volume . . . Centrifugal Pumps handle the large volumes of water used in gas production . . . I-R Portable Compressors and Air Tools are the teams that tear up roads, dig trenches, calk joints, test pipes for leakage, tamp backfill—noisy, yes, but the noise of speed and service.

**Ingersoll-Rand**

11 BROADWAY, NEW YORK 4, N. Y.

14-957

GAS & AIR COMPRESSORS • TURBOBLOWERS
AIR TOOLS
ROCK DRILLS • PUMPS
CONDENSERS • GAS & OIL ENGINES

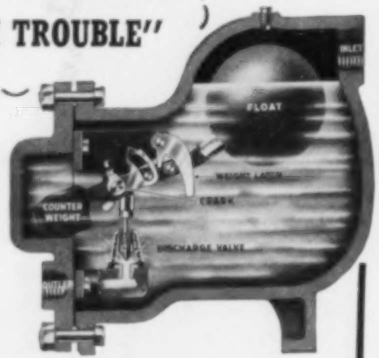
**NICHOLSON** WEIGHT OPERATED **TRAPS**

OFFER

A PRACTICAL WAY TO

**Protect ALL Air Tools**

**and CUT "JAM TROUBLE"**



Weight - operated for positive leak-proof action, Nicholson air traps offer service-proved dependable protection against corrosion and jamming of tools, and blemishing of parts caused by unwanted water and oil in air. Four types. Pressures to 1500 lbs. Stainless steel working parts. "The Nicholson" is the trap that is leak-proofed to prevent loss of air.

*Catalog 444 or see Sweet's*

**W. H. NICHOLSON & CO.** 180 OREGON ST. WILKES-BARRE PA.

*Valves ★ Traps ★ Steam Specialties*

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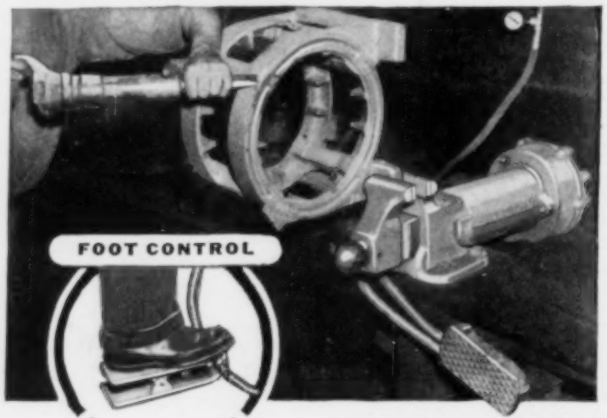
***Vi-Speed*** **Holds**

**FIRMLY AGAINST VIBRATION**



**AIR POWERED**

*Vi-Speed* weighs 110 lbs. giving great stability to work held in jaws and will hold husky pieces rigidly during hammering chipping and grinding—you cannot loosen the piece in the jaws—only foot pedal action will release the piece. *Immediate delivery.* Write for catalog.

*A Few Sales Territories Available*

**VAN PRODUCTS CO.**

**377 ERIE TRUST BLDG., ERIE, PA.**

---

**If You Employ PRESSURE You Need SAFETY HEADS!**

A SAFETY HEAD is your Sentinel of Safety against over-pressure, for use wherever you have a liquid or a gas under pressure . . . 5 up to 25,000 psi. Black, Sivalls & Bryson SAFETY HEADS are simple, positive pressure "fuses" that burst in tension at pre-determined pressures and temperatures. Every SAFETY HEAD is tailor made to fit the specific job for which it is designed. Get more relief capacity per dollar cost. SAFETY HEADS can readily and easily be designed for your needs just as they have for thousands of other plants.

Write today for complete details, latest catalog. Address the Special Products Division, Executive Offices, Black, Sivalls & Bryson, Power and Light Building, Kansas City 6, Missouri.

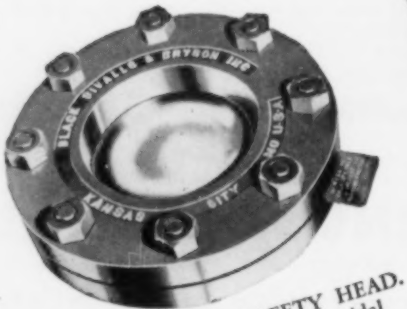
*Foreign Inquiries Invited*

BLACK, SIVALLS & BRYSON, INC.

EFFICIENCY RELIABILITY

KANSAS CITY OKLAHOMA CITY

Cable address: Black, Kansas City, U.S.A.



● B S & B SAFETY HEAD. Shows preformed spheroidal rupture diaphragm.

BLACK, SIVALLS & BRYSON INC.
KANSAS CITY U.S.A.

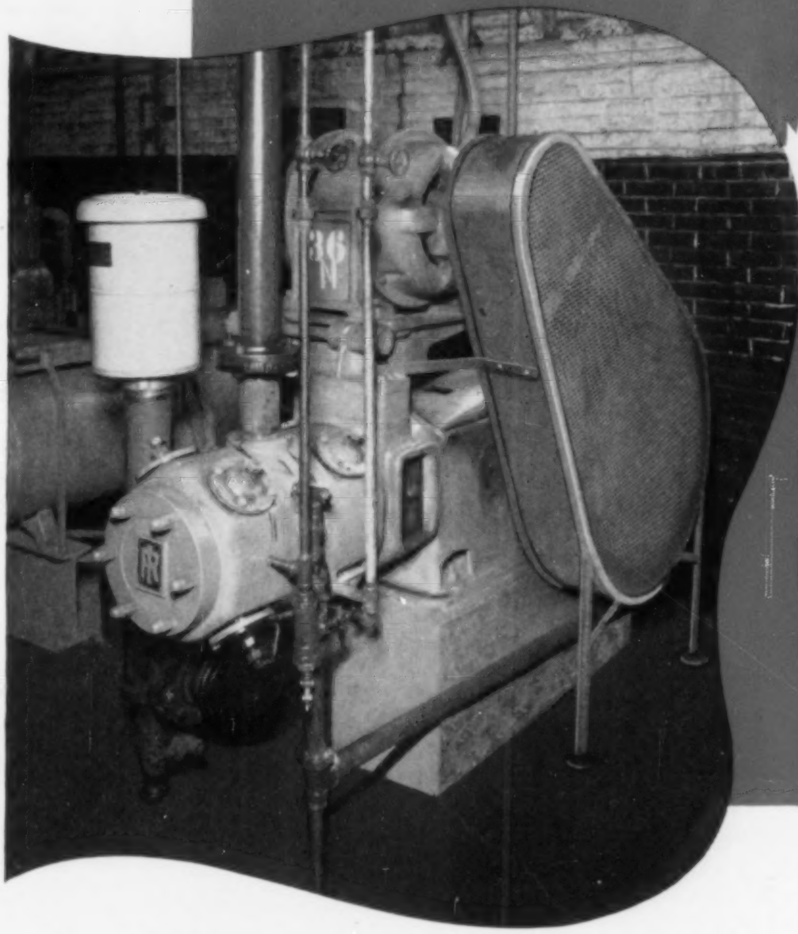
● SAFETY HEAD diaphragm burst by over-pressure. Note full discharge opening.

(19)

Another Ingersoll-Rand ES Compressor proves that

Tapered Roller
TIMKEN BEARING
EQUIPPED

means anti-friction performance at its *Best*



This Ingersoll-Rand 7 x 7 ES Compressor is installed at the plant of a large bleaching, dyeing and finishing company to supply air for various purposes. It delivers 100 lb. pressure at 400 r.p.m.

Timken Tapered Roller Bearings are mounted on the crank shaft to (1) eliminate friction (2) promote smooth operation (3) carry radial, thrust and combined loads (4) prevent crank shaft wear (5) hold the crank shaft in correct and constant alignment.

Unless you get all of these advantages in the anti-frictionized compressor you buy you are not getting anti-friction efficiency *in full*. Make sure you have Timken Bearings in your compressors — with the trade-mark "TIMKEN" stamped on every cup and cone.

**TIMKEN**
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

THE TIMKEN ROLLER BEARING
COMPANY, CANTON 6, OHIO

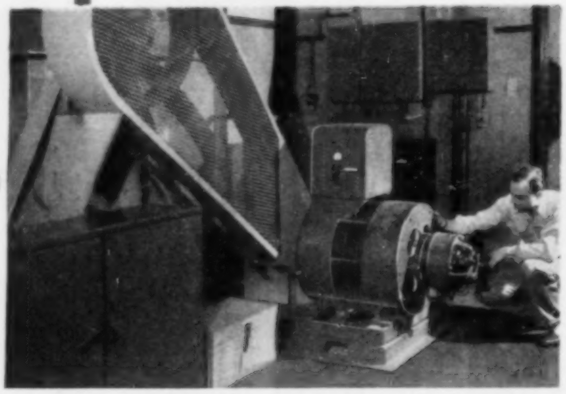
NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ↕ AND THRUST →←LOADS OR ANY COMBINATION

# How to carry
# *MORE POWER*
# *over your lines*

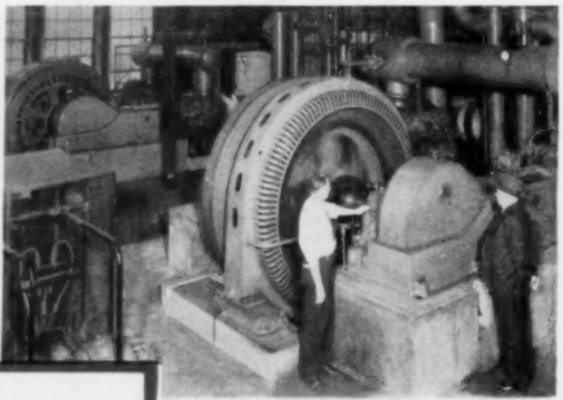
**Power factor improvement—just one of the operating advantages of E-M Synchronous Motors** —removes a burden from your power line. Synchronous Motors, in addition to driving their connected mechanical load, supply magnetizing current to offset the low power factor of induction motors and other equipment. Large-power Synchronous Motors may often be added to existing lines and transformers without raising kva to a level requiring larger feeders, transformers and control equipment.

Because transformers and distribution lines are limited in their kilowatt capacity by the total kva they must carry, Synchronous Motors—by furnishing leading kilovars—replace lagging kilovars in the line with kilowatts for useful work. Providing your own leading kilovars, rather than buying them from the power company, usually results in reduced power billing. As a further benefit, steady voltage is maintained on a higher level than would be the case at a lower power factor.

Besides these savings and advantages, E-M Synchronous Motors give you constant speed, wide range of speed ratings, high stability under voltage dips. It's this double-duty performance that makes them the most efficient drive in industry.

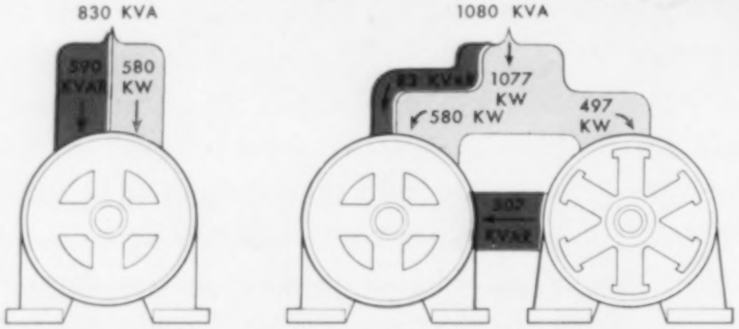


● One of five E-M Synchronous Motors applied to air conditioning fans to improve power factor in a large engine gear plant in Indiana. The motors are 60 hp, 1200 rpm.



● Both of these 500 hp, 180 rpm Synchronous Motors operating air compressors at Motor Products Corp., Detroit, Mich., feature power factor correction at 0.7 leading pf.

## POWER FACTOR MAKES A DIFFERENCE



600 hp of Induction Motors operating at 0.7 lagging power factor —580 KW, 830 KVA, 590 KVAR.

600 hp of Induction Motors operating at 0.7 lagging power factor —580 KW, 830 KVA, 590 KVAR.

600 hp of Synchronous Motors operating at 0.7 leading power factor— 497 KW, 711 KVA, 507 KVAR.

In the system operating at low power factor the lagging kilovars carried by the line may equal or exceed the kilowatts doing useful work.

Addition of Synchronous Motor drives to this system permits doubling the horsepower capacity, with only a 30% increase in kva.

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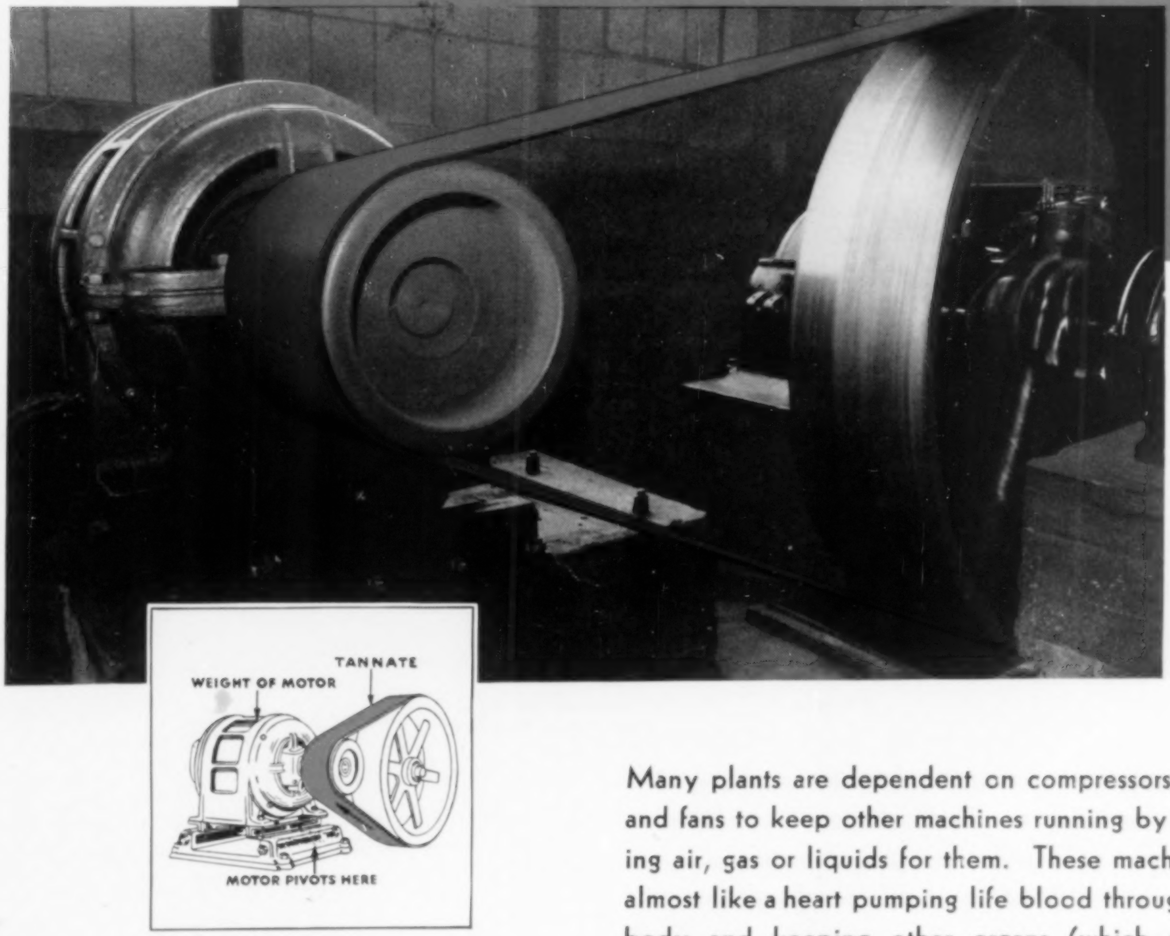

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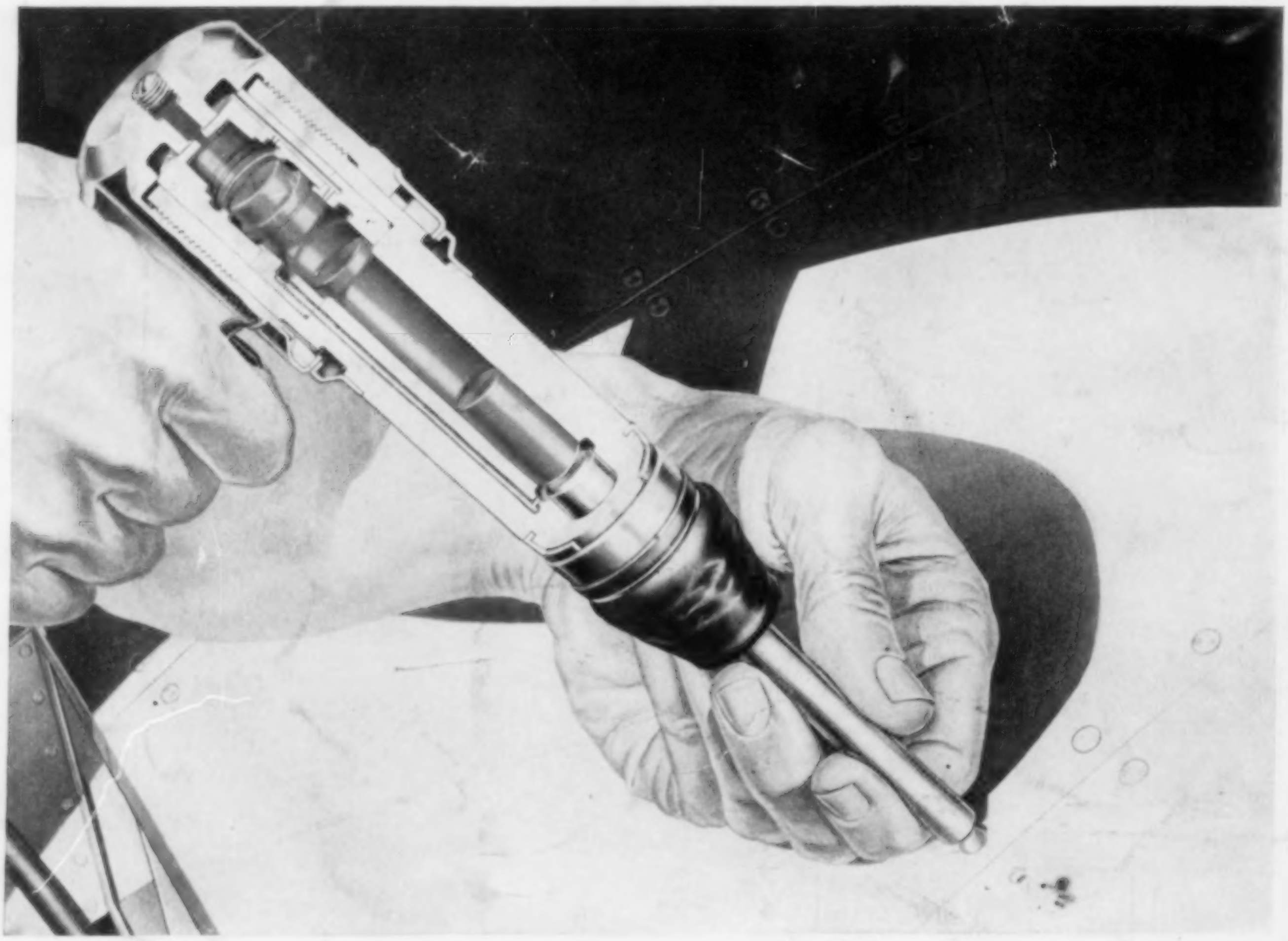

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The piston inside this riveter flies back and forth thousands of times per minute. It delivers a resounding blow on the anvil block at every stroke.

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